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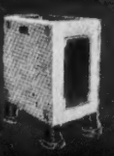

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Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

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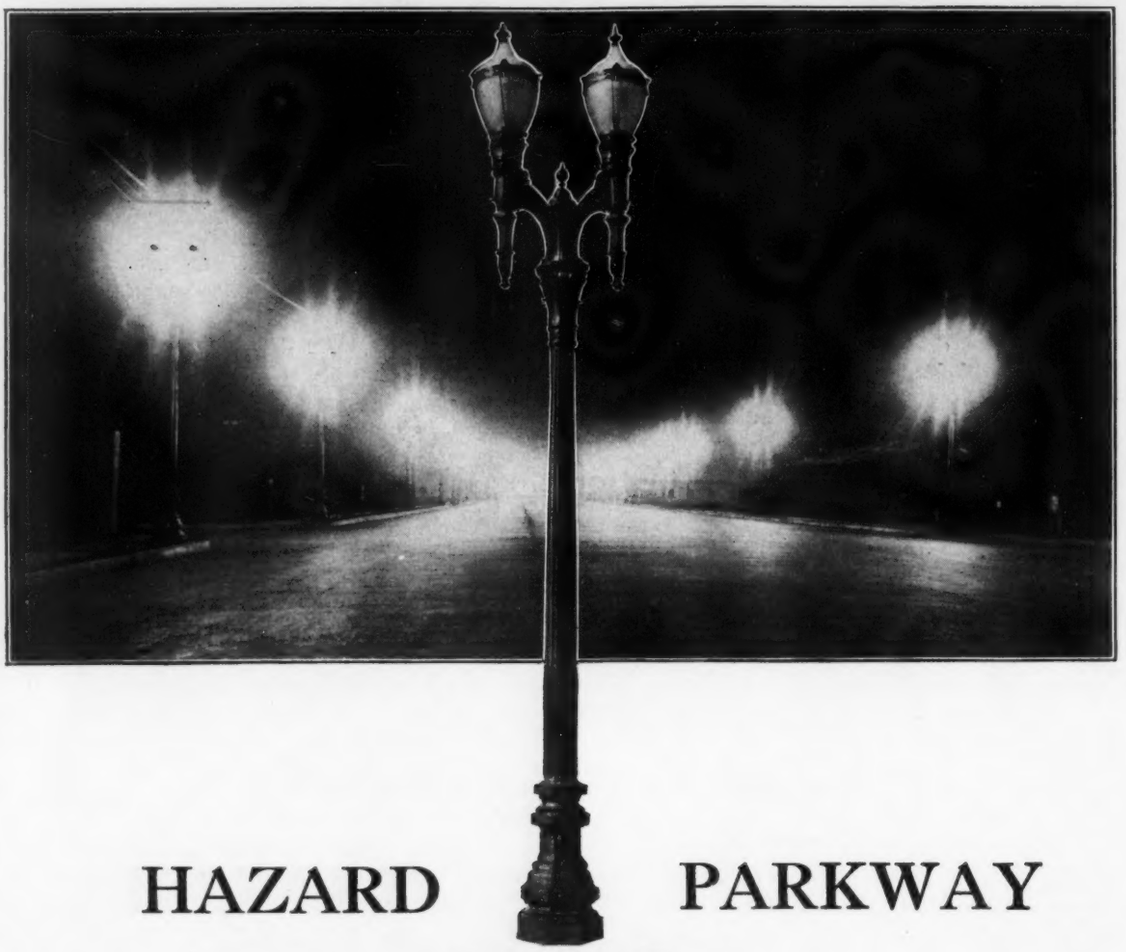
HAZARD



HAZARD PARKWAY CABLE

ATTRACTIVE by day and efficient by night, this installation of street lighting at Burbank, Cal., with Hazard Parkway Cable has recently been completed.

Hazard Parkway Cable carries its own conduit of rust protected steel, and by the elimination of expensive conduits, greatly lowers the cost of lighting installations without sacrifice of durability.

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The Way to Get Business

IT OUGHT to be apparent that in the electric light and power industry, as in every other, the way to get business is to go after it. No operator should delude himself by the idea that he has all the business in sight or that he is approaching that *ignis fatuus* of this industry, saturation, because that is as elusive as ever. Consider, for example, the case of the Southern California Edison Company. If there is any section of the country where people have been educated in the use of electricity and where as a consequence electricity is liberally and universally applied, it is in that garden spot. And yet the Southern California Edison Company adds to its load at a greater rate than most other companies. Why? Because it is farseeing and aggressive.

During the past five years its budget was $138,000,000 —chiefly for engineering. During the next five years its budget will approximate $130,000,000, and most of it will be spent for commercial development. This year it has already added an additional 300,000 hp. of load to its system, or an increase of approximately 40 per cent. Now, there is nothing spectacular about the territory of the Southern California Edison Company. It consists for the most part of small cities and towns surrounding Los Angeles. The company does not operate in the latter city, its distribution system having been acquired by the municipality some years ago. Literally speaking, it serves virgin territory, where the settlers have to wrestle with the desert for a livelihood and where the public utility company has to work hard for every extra horsepower of connected load. And, broadly speaking, what is possible in southern California is also possible elsewhere. With the same will to succeed, the same confidence in the superiority of electricity, and the same ingenuity in adapting it to the everyday needs of the people, the public utility companies of the country could double their output in three years. The business exists. The thing to do is to go out and get it.

* * * *

Code Hearing Very Encouraging

LAST week on Thursday and Friday the electrical committee of the National Fire Protection Association held an open meeting in New York City to consider objections and possible additions to the 1928 National Electrical Code. Grounding was the principal subject discussed. There was a large attendance, and the comments made showed surprisingly little difference of opinion. Evidence was submitted on the advisability of including the polarized identified circuit wire as a method of grounding under certain restrictions, and, while any decisions to modify or amplify the code cannot be made except by the electrical committee, the situation looks encouraging. It is apparent that the question has been approached as a policy matter, as it should be, and not wholly on the basis of technical details.

A large part of the success of the meeting was due to the ability of the chairman, A. R. Small of the Underwriters' Laboratories. He demonstrated his competence to take an argumentative situation in hand, break it into its essential parts and bring out both sides of the discussion in such a way that no one could accuse him of partiality. His periodic summary of evidence presented was most clarifying. With the possibility of every code change raising arguments if the situation is not properly handled, it is indeed fortunate that Mr. Small is chairman of the committee which acts in the capacity of judge.

* * * *

Thrilling and Fascinating Research Conference

"THRILLING" and "fascinating" were terms used by several speakers at the Baltimore meeting of the National Research Conference on impregnated paper insulation to express their opinions of the value of the meeting. Their attitude was supported by many others. One leader in research declared that it had advanced his education on insulation more than anything before.

As Dr. J. B. Whitehead, the chairman, declared, the purpose of the meeting was to uncover problems and attempt to show methods of avoiding causes which brought undesired results. Based on what the American Telephone & Telegraph Company is spending for research, the power utilities should be spending $300,000 on cable research alone, according to D. W. Roper. Since power utilities do not compose a unified "power trust," as some people believe, the best results for a given expenditure can be obtained only by co-ordinating effort and facilities and developing researchers.

Among interesting features brought out were that high pressures as well as low vacuums are developed within cables under operating conditions; that water may be formed within cable from ionic bombardment and polymerization of compounds; that the nature of compounds which will deteriorate the least under ionic discharge may be determined; that marked harmonics are produced in the charging current of poorly impregnated cables; that ionization occurs chiefly at low temperatures and low loads; that a large proportion of failures are due to cable installation and operation; that preliminary tests simulating operating conditions are necessary; that peculiar characteristics have been detected between the thermal and disruptive breakdown values of insulation; that a quantitative relationship between power factor and ionization is desirable, and that faulty impregnation can be detected in preliminary tests.

While this meeting was well attended, advantage was

not taken of the opportunity afforded by as many men as could have profited thereby. The conference is not concerned only with cable insulation but with insulation as a whole. Fundamental problems are involved in both. It is trusted that Prof. Comfort A. Adams' suggestion that the conference solicit the active co-operation of foremost physicists and chemists will be carried out and that these men will recognize the value to themselves that will come from participating in this fundamental work.

* * * *

"Pinch-Hitting" for Labor

SPEAKING before the Boston Chamber of Commerce recently, John Hayes Hammond touched briefly upon the problem of non-employment, pointing out that it is better to suffer from a shortage of labor due to restricted immigration than to have large numbers of men and women out of work because of a surplus. A shortage of labor has compensating advantages, among which is the necessity of having recourse to labor-saving machinery, which results in an enormous increase in the productivity of labor and consequent decreased cost of production. This in turn, besides conferring benefit upon domestic consumers, is an important advantage in winning foreign markets. Thus the electrical industry, as a tool for speeding up production through advanced applications of light, heat and power, contributes to the upbuilding of both domestic and foreign trade. It is an invaluable link in the economic chain, constantly releasing the energies of men and women for other tasks of immediate or potential value. The incentive toward the still greater development of electric service rests upon fundamental economic needs and so stabilizes the demand of the business world upon the power industry.

* * * *

More Light on Electric Water Heating

DOMESTIC electric water heating has received further recognition as an important revenue-producing load for central-station companies from the Empire State Gas and Electric Association's committee on electric water heating, whose investigation and report are abstracted on page 1039 of this issue. The findings and recommendations of the committee show that the residential customer's energy consumption can be increased by from 300 to 600 kilowatt-hours monthly without increase in plant or service equipment. Under the conditions outlined, use of the electric water heater offers a solution to the perplexing problem of low average per customer use of service. The load has excellent power-factor and load-factor characteristics, and, based on what customers can afford to pay for the service, this business produces a very attractive revenue.

In some respects, however, the report indicates that further investigation of this load should be made. The recommendations of the committee set up certain limitations on the type, capacity and hours for use of electric water heaters. The report reads: "Domestic electric water heating must be off-peak, low-wattage, storage type to justify low rates for volume sales." This would appear to rule out the use of 3-kilowatt to 5-kilowatt heaters except at prohibitively high rates, which is in contradiction to the experience of some of the Pacific Coast and other utilities where the heaters of higher wattage are being used very satisfactorily both to the customer and the service company. Moreover, strictly off-peak operation may place such rigid restrictions upon the customer's use of the service as to make it undesirable. The thing that is bothering utility companies most with respect to the electric water-heating load is the diversity of both high-wattage and low-wattage heaters. For off-peak operation or on controlled circuits this is not a serious consideration, but for manual or automatic continuous operation more data on diversity factor are needed. Installations of high-wattage heaters in a number of localities indicate that in practice the actual diversity is much higher than is generally believed. The survey and the tests now being made by the N.E.L.A. domestic water-heating committee should clear up any doubt on this point. Meantime, central-station companies in developing the water-heating load should be careful not to impose so many restrictions upon the methods of using energy as to imperil the customer's use of the service or make that service inadequate or undesirable.

* * * *

Superstitions of Certainty

CONSCIOUS scientists are too often but slightly less credulous than their barbaric progenitors and contemporaries. This is no reflection either on their sincerity or their ability, but rather an evidence of the frailties of even the keener human minds. The research man, more than almost any other class of investigator, has swelled the fund of knowledge, torn aside the barriers of ignorance, and rendered life more interesting, more comfortable, longer and, to the hypothetical disinterested observer, more amusing. The thin veneer of learning leaves him still an amazingly credulous manchild. Tomorrow, or this afternoon, he will, he feels, know that which appears to be unknowable. He is enmeshed in the superstitions of certainty.

Sir Oliver Lodge, who is in many respects the greatest of contemporary physicists, maintained a magnificently fine perspective in his delivery of the nineteenth Kelvin lecture before the Institution of Electrical Engineers this year, but in drawing his conclusions leaned strongly toward that which he would like to see proved. Speculation upon the supposed knowledge of our day tempered with an appreciation of the inevitable mutation in our current acceptances nevertheless permitted a splendid evaluation of physics.

"I am myself convinced," said Sir Oliver, in conclusion, "that the ether is a vast store of turbulent energy of which very little has as yet been tapped. Here and there are localized portions, which appeal to us as matter; and these portions exhibit a trifle more of the ether energy when in a state that we call locomotion. They also display another aspect of ether energy when by a new configuration or arrangement of particles the ether near them is put under strain. Only through observation of matter can we gain any knowledge about the ether itself; but free radiation, electric and magnetic fields, gravitation and cohesion are all essentially affectations of something which to our senses only appeals as empty space. Accordingly these experiences act as revelations and are gradually combining to give us a better and closer apprehension of the reality underlying physical phenomena of every kind. To me it seems likely that vital and mental phenomena will be found to be also closely related with the same universal medium, and only indirectly and temporarily associated with matter."

Direct Action on Industrial Heating

RESULTS obtained by a limited number of utilities in building industrial heating load have been excellent, but the majority of the companies have as yet done very little to develop this business. Experience indicates that one or two men specializing on industrial heating will make the load a very appreciable part of the total sales; but electric heat applications must be sold on a specialty basis and cannot be had without organized sales effort.

Industrial heating load is about the most desirable one available today. A considerable part of it is 24-hour load; much of it is off-peak and controllable as to hours' use of demand; it gives a large revenue per unit of connected load, and it is a unity-power-factor load, therefore, requiring increment of cost in plant investment and acting as a corrective agent. In addition, from the utility point of view it is a very desirable load because it can be developed on a pay-as-you-go basis.

Intelligent selling of industrial heating is easily done. Electric heat gives better products, increases the rate of production, lowers manufacturing costs and improves working conditions when it is applied correctly. The applications of electric heat are numerous, and some can be found in every community if sought after. Steel melting, heat treating of steel and drying and baking operations offer large load possibilities. Other applications are melting brass, lead, tin, solder and babbitt; annealing aluminum, brass, copper and steel; brazing operations, firing enamel, melting and heating compounds, galvanizing and japanning and many special processes peculiar to the different types of manufacturing.

Educational work to develop men and pioneering work on applications has reached a stage that enables any utility to develop a practical industrial heating sales program. It starts with a high-grade salesman who knows his business. It ends with increased net revenues for the utility.

* * * *

Compulsory Free Service

UTILITY men in at least one section of the country are confronted with a recurrence of the difficult problem of stolen energy and are struggling to secure adequate payment for their product. Many methods of considerable ingenuity have been brought to bear in the popular game of beating the electric light and power company. Meters are tampered with in highly skillful ways, "fixers" have definite routes and customers, and utility meter readers are prevented from entering the premises until "jumpers" and "stops" have been removed. Even glass-covered meters are small obstacles where these petty thieves operate.

Metermen are well aware of the situation and have detected and apprehended many dishonest "customers," but there the case ends. It is extremely difficult to obtain adequate support in the courts, and in one state recourse to the judiciary has virtually ceased because of the proven impossibility of securing conviction and penalty. The matter has degenerated into a battle of wits between some of the served and the server.

There is probably no law which provides for the supply of service without compensation, and sustained failure to pay one's bill is ultimately a fairly sure way to be deprived of service. Assuredly, it is likewise equable that the full amount due for service be received. Unfortunately, in the great commonwealth in question the public service commission has required that service be continued even to those known to utility men to tamper continually with meters. This is palpably unfair, for, in the final analysis, the honest citizen must pay for the dishonest one's light and power. More drastic legislation is hardly to be regarded as a satisfactory solution of the difficulty, for it is the enforcement rather than the provision for it that lends complexity to the situation.

There is no fundamental factor in the supply of service to a community, even under a monopoly, which should require that privileges be accorded to those who rob the purveyor. Commissions and courts should recognize this and should not be swayed by misplaced leniency. The business of supplying electric light and power to a community is, after all, largely a strictly business proposition, although not hostile to the recognized modern commercial policy of avoiding antagonism through short-sighted policies.

* * * *

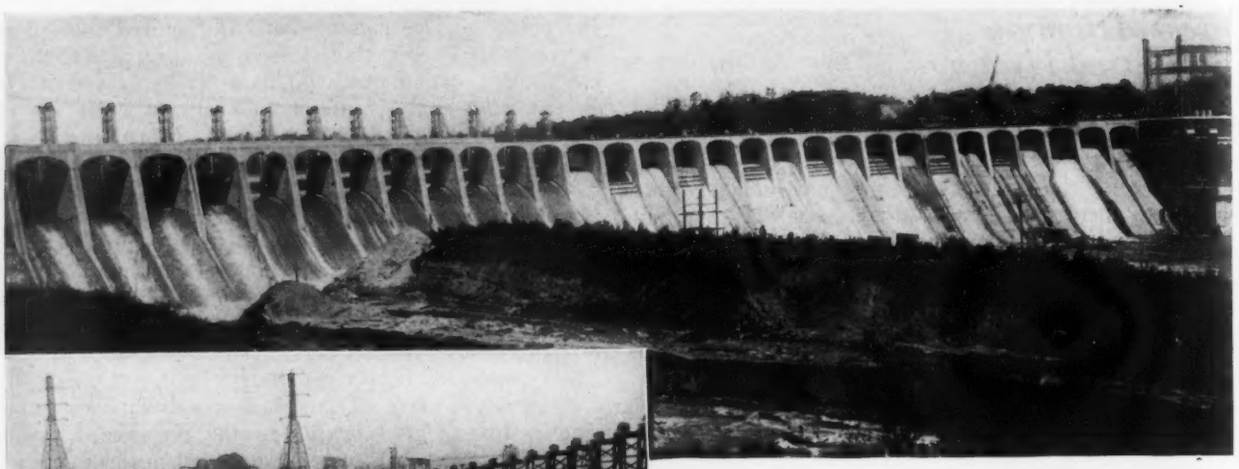
Switchboards of Tomorrow

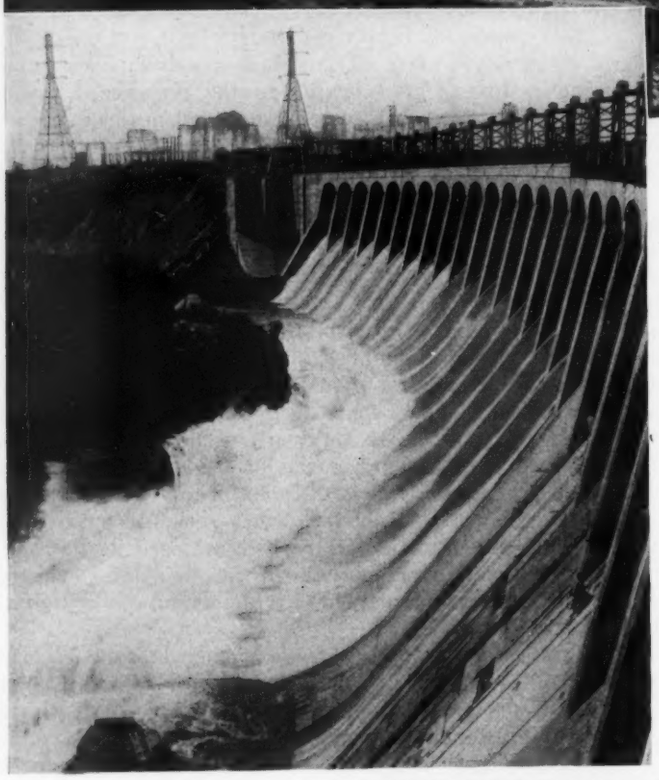
POWER-PLANT switchboards considered with the conduit and control cable connecting them with the apparatus controlled cost no small amount of money in a plant having a number of large units. They occupy much space, require thousands of feet of conduit and control wire, and in some cases become too extensive for one man to supervise. When a saving of $10,000 per generator unit controlled can be made by using a type of switchboard which is different from stock models, as has been reported in one case, serious consideration might be given to the kinds which are used in the Louisville hydro-electric station, in the Holland Vehicular Tunnel and on the new 220-kv. substation of the Ontario Hydro System.

In these cases miniature switchboards have been installed. Not merely small panels with apparatus more closely grouped, but boards occupying one-tenth the length of standard switchboards with miniature control switches, signal lamps and either miniature meters or no meters. Some meters are not essential to switching operations and consequently do not have to be grouped at the operating board, as the design of modern standard boards has already shown.

These miniature boards, because they are small, can be placed anywhere. Because they occupy a small area they can be supervised by one man. By utilizing auxiliary relays that operate on small currents the control wiring can be greatly condensed and made less costly to install. While the first cost of miniature switchboards is possibly higher than that of standard switchboards, it is reported that the total installation cost has been reduced as much as the amount previously mentioned per unit controlled.

Unless operating troubles arise because of the more compact character of the miniature boards, their more delicate control switches and smaller control wiring, it is possible that electrical engineers who are responsible for keeping down the first cost of stations without sacrificing reliability of service may find it advisable to make future switchboards as different from the common run today as present switchboards are different from the old hand-operated, live-front boards of yesteryear. The new miniature switchboard offers possibilities in stations having six units or more, and the trend is now in the direction of a further concentration of control at equipments with miniature remote controls at a distance.





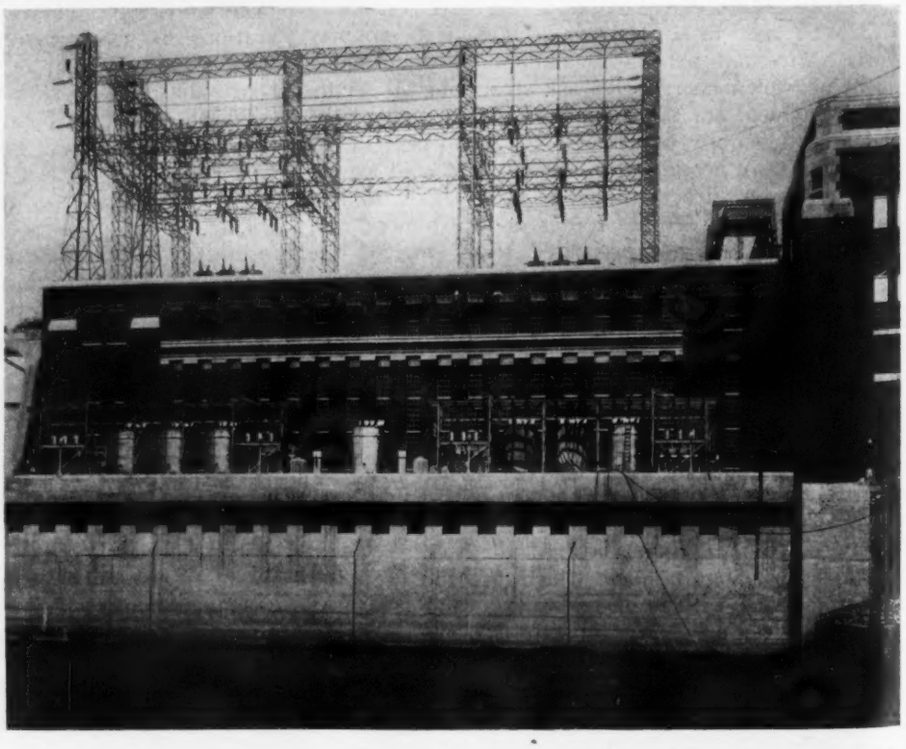
Jordan Dam Completed

THE Alabama Power Company has recently placed in operation the first unit of its hydro-electric plant at Jordan Dam on the Coosa River, Alabama. The entire group of four 29,000-kva. generators will probably be in operation by Dec. 1.

The total span of the dam is 2,206 ft. The construction provides for future installation of locks in the event that the Coosa River is made navigable. A canal approach to the future lock has been excavated.

At the far end of the dam from the power house is the outdoor substation.

Outdoor switching equipment is located on the roof of the power house. Transformers and low-tension breakers are at a lower level.



Guiding a Group of Small Utilities

Some policies that have been largely instrumental in bringing small and scattered utilities the benefits of a holding company and encourage local initiative

An Interview with

W. A. BUTTRICK

President Twin State Gas & Electric Company, Boston, Mass.

W. A. Buttrick

MANAGEMENT policies are of great interest in this era of increasing syndicate operation because their character largely determines the success of the grouped properties. When small and scattered utilities are brought under centralized control a readjustment period usually follows, in which the establishment of team play between local properties and headquarters sets the course for sound development under the new régime. The history of the Twin State company contains so much that is suggestive from the standpoint of co-ordinated administration that a representative of the ELECTRICAL WORLD recently asked President W. A. Buttrick to outline the methods by which the various divisions of this organization have been led to prosper as a group.

Mr. Buttrick pointed out that the several divisions of the Twin State company in New Hampshire, Vermont and New York have been under centralized management for some years, executive headquarters being at Boston. The economic crisis brought about by the World War came to a head in 1920, and at that time it was seen to be vitally important to both unify and decentralize the administration of these scattered utilities. Improved team play between headquarters and the local branches of the company was brought about and renewed encouragement given to local managerial initiative, along with a more effective standardization of practice in purchasing, accounting, engineering, sales and public relations.

"Our local managers had to a great extent been playing lone hands in the company game," said Mr. Buttrick, "and so were not very conversant with what was going on in the other divisions. Some were separated by a hundred or more miles. Standards of engineering, operating, sales and accounting practice were not sufficiently uniform to allow satisfactory comparisons between the various divisions. We are sure that much of the success which has attended the later post-war operation of these properties is due to giving each local manager a continuing picture of the affairs of the company as a whole. Headquarters executives and company heads promptly put this policy into effect and it has never been allowed to lapse. Our local men became concerned with statistics in a competitive way. Regular monthly comparisons of divisional performance are of course routine matters. What "hits the local executive where he lives," as the saying goes, are such interdivisional unit check-ups as the ratio of investment to earnings; the ratio of operating expenses to gross revenue; kilowatt-hour sales per residential customer, per capita, and so on. Figures of this kind are constantly being set up bogey fashion and the friendly rivalry resulting is good from all angles."

"Doubtless it was necessary to take the steering wheel as to expenses?" queried the ELECTRICAL WORLD man. "Budget control was strengthened," replied Mr. Buttrick, "and it seemed well to adopt a rigorous scrutiny of all outlays because previously a lack of comprehension or proper understanding prevailed in certain parts of our territory in regard to many expenditures. I am sure the executive office was looked upon as pretty hard-boiled in this connection, but the ability to say 'No' as well as 'Yes' at the right time is literally of tremendous importance in handling the affairs of properties such as ours, serving small cities, towns and extended country areas not blessed with the volume of earning power normally found in densely populated communities. I am free to say that I believe our managers appreciate today the wisdom of this policy and accept it with cordial understanding now that they realize their greater responsibilities. Close attention had to be paid to the prompt collection of accounts receivable. Our credit with the banks, and with vendors, for that matter, improved rapidly under this rigorous régime, with the result that subsequent necessary financing was accomplished without difficulty. The status of our bonds tells the story."

GUIDANCE, NOT DOMINATION, IS KEYNOTE

Asked how the important changes were put into effect, Mr. Buttrick said: "We simply went into the field and lived with our managers and their problems. Changes in personnel were negligible and from the start we made it clear that our intentions were to be constructively helpful rather than critical. In this organization set-up it is well to look out for proper co-ordination with the executive office in its relations with local properties and we have 'watched our step' to avoid hasty judgment or orders to the men in the field. We do not intend to bedevil our resident executives and their business families with a flood of orders, but are anxious to encourage local initiative, freedom of suggestion and discussion.

"We feel our managers are competent in operating and ordinary construction matters. The broader devel-

opment work is better planned and put through by our central engineering staff, but after the laying down of general policies room remains for the local executive to concern himself with a good deal of interesting and important work bearing upon the betterment of operating conditions, economical construction of line extensions, improved relations with industrial customers and, of course, all manner of public relations associated with sales activities and other matters. Promotional rates have been warmly indorsed and some of our properties are making a creditable showing in the sale of energy to the home. Guidance rather than domination is the keynote of our policy, and a surprising amount of decentralization of management has been attained."

What Is Known About Glare?*

A four-part classification of glare effects offers a basis for comparative analysis of earlier investigations of visual phenomena

By P. S. Millar and S. McK. Gray
Electrical Testing Laboratories, New York

BENEFICIAL effects of artificial light are often marred by the intrusion of glare, which is manifested in a variety of deleterious effects. Our knowledge of the ramifications of these effects is quite limited and the problem is one for whose solution more research is needed. The principal effects of glare may be classified as:

1. Decrease in ability to see.
(a) Measurable reduction experienced by observers at concentrated attention under test conditions.
(b) Further reduction experienced at low levels of attention in practice.
2. Ocular discomfort.
3. Ocular fatigue.
4. Marred appearance.

There are two principal points of view from which a study of glare may be undertaken. These are:

1. Discovery of laws governing ocular reactions in the presence of glare.
2. The effects of glare in lighting practice.

Both, of course, are important. It is essential to the full comprehension which should underlie lighting technique that the problem should be resolved into its elements and that there should be a determination of the nature and magnitude of the effects to which each gives rise. Those experimenters who have studied these matters in the laboratory have advanced knowledge of the subject very materially and in a way that is indispensable to a final solution of the problem. Yet much remains to be done along similar lines before a complete solution will be possible.

When the nature and magnitude of the effects of the several elements of glare phenomena shall be known it will become desirable to combine them to form a composite for comparison with observed experience of the effects of glare in practice. Not until the scientific solution of the problem shall be brought into accord with practical observations of the effects of glare can it be said that glare is fully understood.

There has been observed a tendency for experimenters who have studied some one manifestation of glare under one set of laboratory conditions to apply their results to practical cases in which other manifestations of glare are to be apprehended and other conditions prevail. Such a procedure is daring and may yield correct results. It would be more acceptable, however, if deductions from such laboratory experiments could be put to practical test under competent observation in order to ascertain if they are confirmed. Only if such confirmation can be had will illuminating engineers be justified in accepting conclusions for practical cases which are deduced from laboratory experiments under one set of conditions dealing with only one manifestation.

The Relation of Glare to Field and Test-Object Brightness.—In practice, increase in the light output of glare sources is often accompanied by increase in the illumination of objects which are viewed as well as in that of immediate surroundings. Likewise, when a glare source in practice is close to observed objects these objects are often illuminated to a higher intensity than when the glare source is removed to a considerable distance from them. In many of the laboratory studies which have been made the test object has been independently illuminated. In some of them the surroundings or background of both the glare source and the test object has been independently illuminated. In such experiments the conditions have deviated from the usual practical case in that an increase in the light output of the glare source has not brought a corresponding increase in the illumination of its background nor a corresponding increase in the brightness of the test object. The statement may be ventured that glare in its varied manifestations is not so serious when the glare source is surrounded by an area of high brightness and when objects viewed are of high brightness. In experiments to which reference has been made this usual condition of practice has not obtained during the tests. In applying the results of laboratory experiments to the consideration of glare in practice it would seem important therefore to make due allowance, at least in some cases, for this difference between test and practice.

The Application of Liminal Data to Practical Conditions—Most conclusions and inferences from glare experiments in the laboratory are based on relative findings in determination of least perceptible differences. Whether or not direct application of such results may be made to practical conditions in which threshold perception is often not involved is a question which the present writers do not presume to answer. In practice glare is of serious consequence in interfering with ease, comfort, certainty and satisfaction of vision. Are its manifestations in these particulars indicated by results obtained under threshold test conditions in the laboratory? There is certainly a vast gap between the two sets of conditions and each bit of evidence as to the reliability of application of such laboratory tests to service conditions will be very reassuring.

Most studies of the effects of glare which have made available quantitative data fall within class (1) (a) of the foregoing classification. These, as a rule have indicated to what extent a glaring source within the field of vision under certain conditions has diminished the ability of subjects to perceive test objects whose location and general character were known, and upon the perception of which the subjects concentrated to the exclusion of other matters from their attention.

In summarizing the results of experiments, it is of interest to compare the correlations found by various investigators, under their respective conditions of experiment, to exist between the reduction of visibility due to

*Abstract of a paper, "Glare—Its Manifestations and the Status of Knowledge Thereof," presented by Mr. Millar at the International Illumination Congress, Upper Saranac, N. Y., 1928.

glare and the various characteristics of the glare source and the surroundings. In many determinations there is practically a unanimous finding that the reduction of visibility due to the presence in the field of view of a bright light source increases with increase of candlepower of the glare source, decreases with increase of distance of the glare source from the observer, decreases with increase of angle of departure of the glare source from the visual axis and decreases with increase of brightness of the surrounding adapting field. There is evidence that the reduction of visibility experienced by test subjects is directly proportional to the intensity of the luminous flux from the glare source at the eye of the observer and that it is independent of the brightness of the glare source.

An analysis of the conditions under which each set of determinations was carried out, while not complete, indicates the following: (1) Practically all of these investigations involved the use of independently illuminated test objects. (2) The shapes and visual angles of the test objects varied to a great degree. (3) Uniformity of criteria of perception of the test object was noticeably absent. (4) The distance of the observer from the test object varied over a range of 0.8 ft. to 100 ft. (5) In some cases the illumination of the background was partially and in one case completely derived from the glare sources, while in most cases it was independently controlled. (6) In some instances the observer was limited to a certain short period of time in which to perceive the test object, while in other instances no such limitation was imposed.

The four effects of glare described herein are not definitely separate. They overlap oftentimes and in many cases it may not be possible to dissociate one from the other. But in order to insure full appreciation of the detrimental effect of glare, it seems desirable to discuss them separately. It is well known that the public, which has not devoted attention to the subject, is unconscious of lesser degrees of glare which occasion the lighting expert real discomfort. Where it is not possible to convince a layman of reduction in ability to see occasioned by glare, it is sometimes easy to convince him that glare occasions discomfort and that the appearance of a scene or an interior is marred by the presence of glare. On these accounts a subdivision and separate discussion of the several aspects of glare are considered to be important.

Summing up this review of the subject of glare, it may be said that published results of experiments for the most part have dealt principally with one important aspect of the subject, namely, reduction in ability to see. Glare is at least as detrimental as test results have indicated and usually is considerably more detrimental because its effects are likely to be more serious in practice than they are in test and because in addition to its blinding effect glare produces ocular discomfort and fatigue and mars the appearance of objects within reach of its influence.

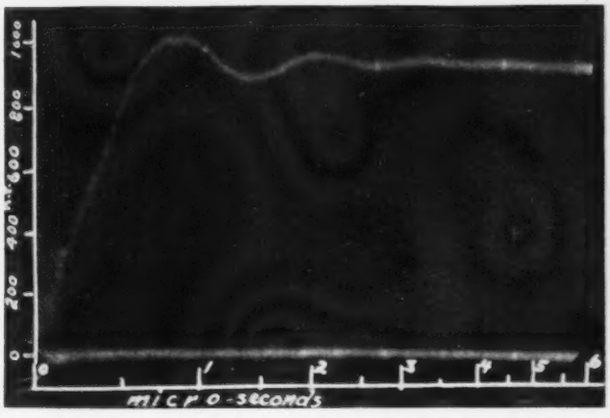
Lightning-Generator Wave Form

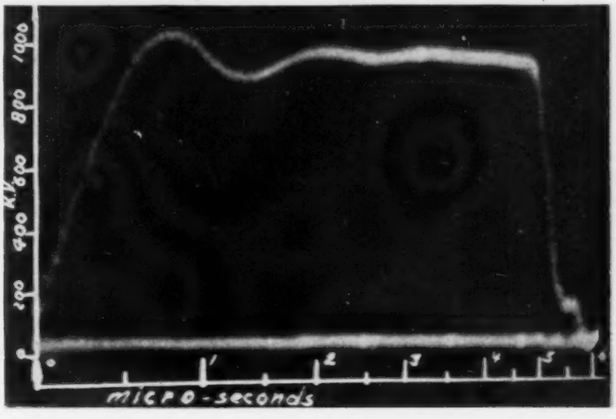
By F. D. Fielder
Material and Process Engineer
Westinghouse Electric & Manufacturing Company

IN TESTING high-voltage insulation with impulse voltages it is necessary to know accurately the wave form of the impressed voltage. For this reason a cathode-ray oscillograph was installed recently in connection with the 2,000,000-volt surge generator* at the Westinghouse high-voltage laboratory. Typical oscillograms are shown.

These oscillograms are interesting for several reasons: The rectangular axes aid visualization. The logarithmic time scale permits analysis of the front or most important part of the wave. A time lag of flashover of several micro-seconds is indicated for suspension insulators on this particular type of wave. It is shown definitely that the voltage rises along a smooth curve and not in steps in spite of the progressive breakdown of the twenty interstage sphere gaps of the surge generator. Actually the surge is not applied to the apparatus under test until the progressive series connection of the condensers is complete. This eliminates any tendency toward a stepped or jagged wave front.

To obtain these oscillograms it was necessary to synchronize, within a fraction of a microsecond, the cathode voltage, the surge-generator voltage and the timing-wave voltage. For this purpose a very ingenious tripping arrangement has been developed by J. J. Torok. The methods used allow records to be made up to the full voltage of the present generator, including the full range of wave-front steepnesses. Thus an accurate check on the actual wave forms and complete data on the surge characteristics of apparatus are obtained.



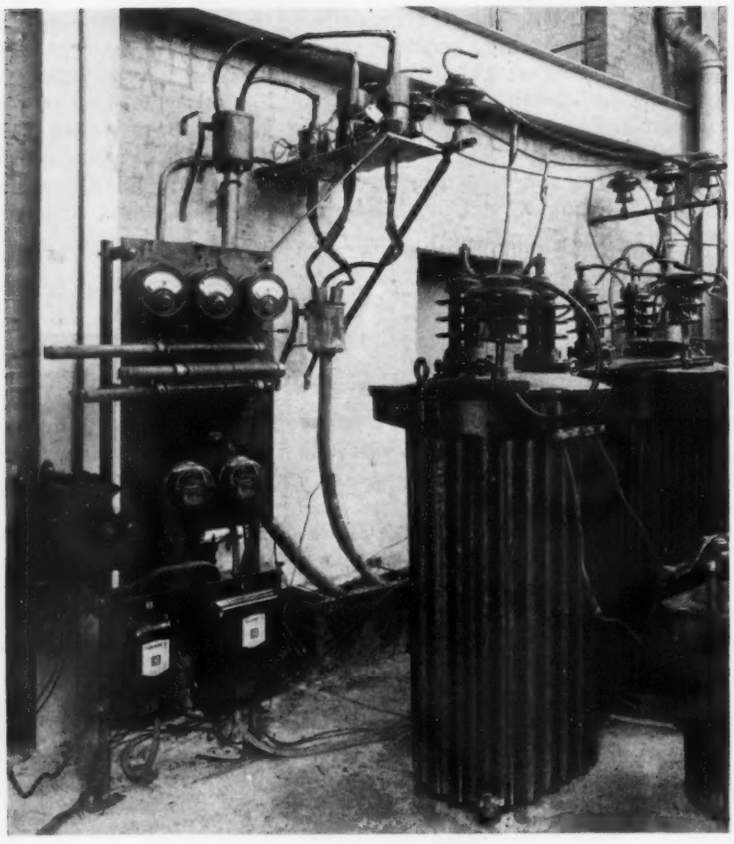


Figs. 1 and 2—Front and part of the tail of a wave on which flashover did not occur and an impulse voltage wave during test in which an eight-unit string of suspension insulators flashed over

*Electrical World, Aug. 4, 1928, page 205.

Water

Cable with perforated sheath immersed in water shows very slow moisture permeation. Failure occurs after one-year test



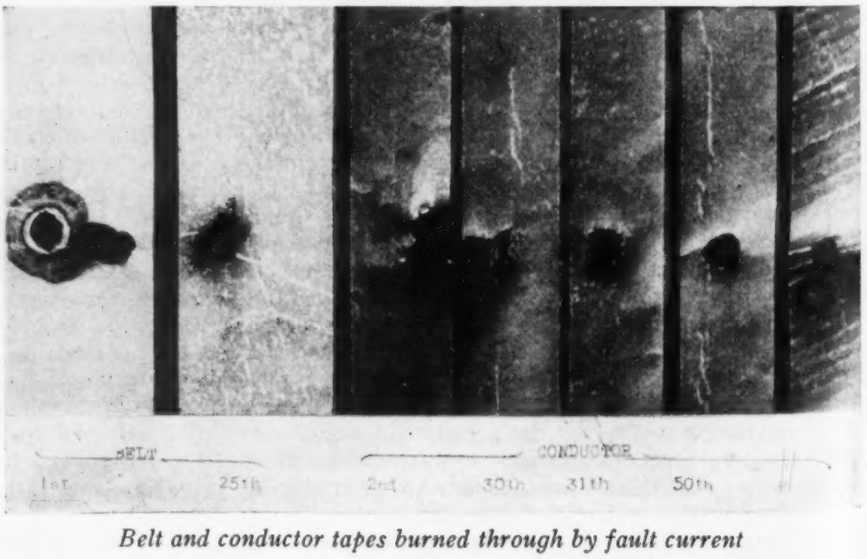
Test apparatus in operation

UP TO about a year ago a number of cable failures in the Detroit Edison underground system had occurred in duct runs containing water in quantities varying from very small to very large. Examination disclosed that the moisture content of the insulation surrounding the faults was quite varying and that in several instances an appreciable amount of bleaching had taken place. Questions arose as to whether holes in the sheath had permitted water to seep in and permeate extensive areas of insulation that were frequently found to have been affected or whether the moisture had entered the cable subsequent to the failure; whether ordinary ground water or badly contaminated water, which was found in certain localities, was responsible for the bleaching, or whether the bleaching was caused at the time of failure by the arc in the presence of water.

In order to determine what actually occurs under known conditions, an experimental set-up was made, in which about 15 ft. of a sample of three No. 2/0 conductor, 24-kv. belted type, $\frac{9}{32}$x$\frac{7}{32}$-in. lead-covered cable of 1926 manufacture was submerged in a trough of water removed from a manhole in the area where contaminated water was found. Electrical connections were made to this cable so that a potential of 24,000 volts and a loading of approximately 150 amp. could be imposed upon it. The operator at the substation where the test was conducted was instructed to throw load upon the cable at 7 a.m. and to remove load at 5 p.m. every day, the voltage of 24,000 being maintained continually, thus simulating the radial expanding and contracting effect of a cable in actual service. It was assumed that this pumping action would tend, through the cooling and contraction of the cable after the removal of its load, to draw in moisture through the holes in the sheath, and thus as far as possible reproduce conditions under which a cable with a hole in its sheath would operate. The cable, previous to its use on this test, had never been in service.

The cable was fitted with standard No. 2/0 A.W.G., 24-kv., indoor-type potheads filled with the black asphaltic base No. 227 compound. Three holes, each $\frac{3}{16}$ in. in diameter, were made through the lead sheath in such position that, when placed in the trough containing the water, the cable would lie with these holes uppermost. Their respective positions are shown in the accompanying sketch. Before the start of the test only the center hole was made. The two other holes were made one week later.

Three thermocouples were fitted to the cable, the first under the sheath and against the belt in water, the second on the surface of the sheath in water and the third on the surface of the sheath in air. That portion of the cable containing the holes was placed in a wooden trough 11 in. wide by 12 in. deep and 11 ft. 6 in. long. About 8 ft. of the cable was contained in the immersed



Belt and conductor tapes burned through by fault current

Penetration

in Cable Insulation

By G. B. McCabe

Engineer on Cable Practice Detroit Edison Company, Detroit, Mich.

portion and there was a depth of about 4 in. of water over each hole.

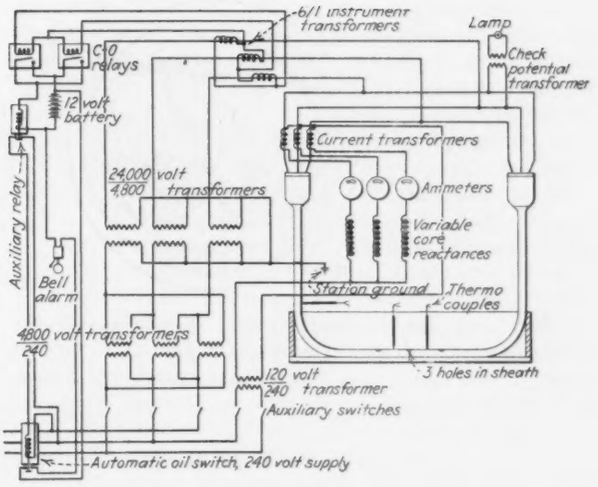
The cable was loaded from a low-voltage source. Each conductor was closed on itself, through short overhead jumpers. The primaries of three current transformers, of ratio 300/5, were included in this triple-conductor circuit, each secondary being connected to a reactance of 10 amp. capacity, with adjustable iron core, and to an ammeter. These three circuits were excited through a switch with 125-volt single-phase supply. The completed set-up was made alive on April 30, 1927, and the loads were adjusted on each of the three conductors to 155 amp. This is approximately 20 per cent overload for this size cable, assuming normal full load as 130 amp.

Megger tests, using a 10,000-megohm instrument, were made regularly each week on all conductors in turn, to ground and to each of the two others. Temperatures, as measured from the thermocouples by means of a Leeds & Northrup bridge, were also taken at these times. All these readings are recorded in the tabulation.

Some time after the test was started it was decided to install a gas collector over each of the holes. These were placed in position on Nov. 21, 1927.

The test was interrupted only three times. In two cases the Y-phase reactance burned out, while in the third a short piece of cable containing a standard joint with an intentional hole at the filling hole, for the purpose of a similar water penetration test on a joint, was inserted in the circuit. In each of the three cases the test was resumed after a three- to four-day shut-down.

Up to within three weeks of the failure of the cable

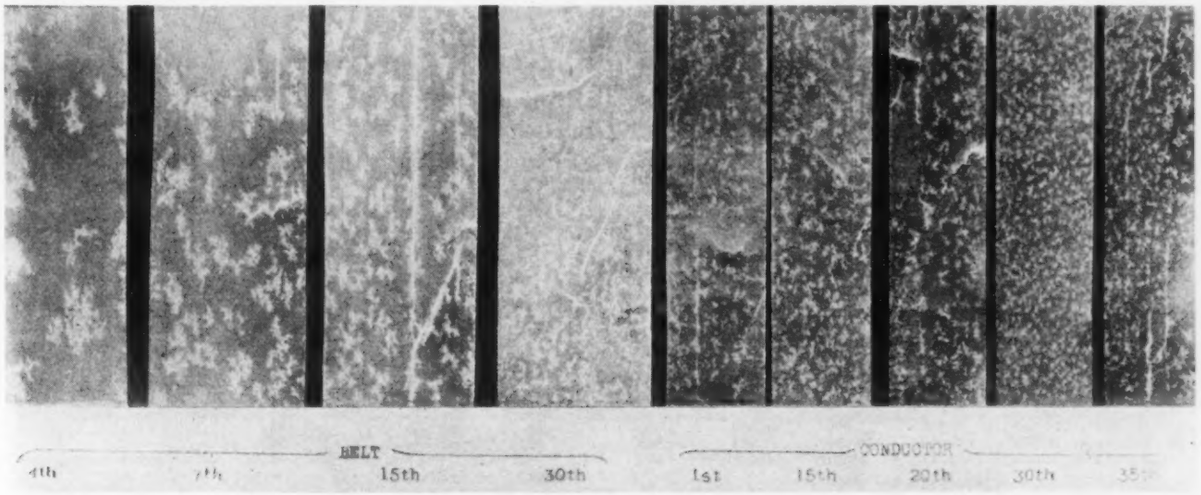


Scheme of water penetration cable test, showing immersion trough and method of controlling voltage and current supply

Potential was provided by means of two banks of single-phase transformers. The supply of 240 volts, 3 phase was stepped up to 4,800 volts through a bank of three 10-kva., single-phase transformers, connected delta-delta, and then from 4,800 volts to 24,000 volts through a bank of three 25-kva., single-phase transformers connected Y—Y. Connection to the overhead jumpers was made through three 6:1 instrument transformers. The secondaries of these transformers were connected to two type CO relays which closed the circuit of a 12-volt battery and an auxiliary relay. This relay, in turn, operated the oil switch which controlled the supply to the set.

the insulation resistance had remained at 8,000 megohms or more. At that time a decided decrease was noted. The resistance to ground of one conductor on April 23, 1928, dropped to 4,000 megohms. On May 4, 1928, it was noticed that potential was indicated on but two legs, the third leg being dead. The oil switch had not opened. The insulation resistance of this leg measured but 1,000 ohms to ground, and of the other two "infinity" and "infinity minus," respectively. Upon investigation it was found that with this particular connection of power transformers the short-circuit current on the high-voltage side of any one of the 24-kv. transformers was so limited that sufficient current was not furnished for relay operation. It was found by measurement that only 0.025 amp. flowed in the relay circuit on the grounding of the 24-kv. side of any one transformer.

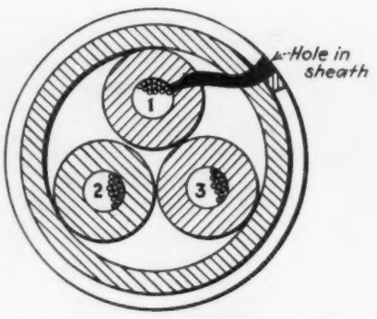
On account of the failure of the relays to operate the



Samples of dendritic formation found in insulation tapes

exact duration of the test is not known. The fault occurred between the weekly inspections on the 365th and 371st days.

No gas was released from the cable through the holes in the lead during the five months the gas collectors were in position. The cable was removed and cut into three pieces, each one including one of the holes in the sheath, which were dissected and examined separately. The sheath of each sample appeared to be in good condition and not affected in any way by its immersion.



Fault current travel through conductor insulation, filler and belt to a point adjacent to the hole in the sheath

The cable failed from conductor to sheath. The failure had started from one of the conductors located about 60 deg. around from the hole in the sheath. It had penetrated the conductor insulation, burning a ¼-in. average diameter hole, burned half of the paper strand forming part of the lateral filler and scorched the remaining jute filler. The current then traveled radially through the belt and burned a ½-in. diameter hole adjacent to the original hole in the sheath. Removal of the sheath and the belt layers revealed the fact that in the making of the original hole the belt had also been pierced to the extent of seven layers. A darkened area, 4 in. wide and extending about half way around, was clearly visible and indicated the presence of moisture, which was proved by means of the hot paraffin test. As the layers were removed this area gradually decreased to an oval 3x2 in. in size.

The uppermost lateral filler, composed of jute and paper and located under the hole in the sheath, was wet for about 1½ in. on both sides of the fault. Neither of the two other lateral fillers nor the center one was wet. Examination of the faulty conductor showed that moisture had penetrated about 50 of the 64 tapes. Starting with an area 2x2 in. on the outside of the insulation, this wet spot decreased in size as the copper was approached until only the edges of the burned hole were wet. The two other conductors failed to show the

Record of Cable Insulation Water Penetration Test

	Date Insulation Resistance Megohms						Temperature in Deg. F.				
1927	1–2	1–G	2–3	2–G	3–1	3–G	Sheath in Water	Belt in Water	Sheath in Air	Ambient	Remarks
4—30	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	55	58	57	..	Reading taken just previous to making alive.
5— 2	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	62	65	80	..	
5— 7	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	64	66	85	..	
5—13	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	66	65	81	65.5	
5—21	Infinity—	Infinity—	Infinity—	Infinity—	Infinity—	Infinity—	63	65	78	62.8	
5—28	Infinity—	Infinity—	Infinity—	Infinity—	Infinity—	Infinity—	62	62	82	62.6	
6— 3	Infinity	Infinity—	Infinity	Infinity	Infinity	Infinity—	69	70	77	68.8	
6—10	Infinity—	10,000	Infinity	10,000	Infinity	10,000	75	75	92	77	
6—17	Infinity	Infinity—	Infinity	Infinity—	Infinity	Infinity—	69	70	85	84.9	
6—24	Infinity	Infinity—	Infinity	Infinity—	Infinity	Infinity	71	71	88	70	
7— 5	Infinity	Infinity—	Infinity	Infinity—	Infinity	10,000	73	72	91	76	
7— 9	Infinity	Infinity—	Infinity	Infinity—	Infinity	Infinity—	71	71	92	77	
7—16	Infinity	10,000	Infinity	10,000	Infinity	10,000	79	78	97	80	
7—22	Infinity—	Infinity—	Infinity—	Infinity—	Infinity—	Infinity—	78	76	90	74	
7—29	Infinity—	10,000	Infinity—	10,000	Infinity—	10,000	77	78	93	79	
8— 5	Infinity	Infinity—	Infinity	Infinity—	Infinity	Infinity—	73	75	89	75.5	
8—15	Infinity—	10,000	Infinity	10,000	Infinity	10,000	76	75	91	75	
8—19	Infinity	10,000	Infinity	10,000	Infinity	10,000	72	72	85	71	
8—26	Infinity	10,000	Infinity	10,000	Infinity	10,000	73	73	87	73	
9— 2	Infinity	10,000	Infinity	10,000	Infinity	10,000	75	78	92	79	
9— 9	Infinity	10,000	Infinity	10,000	Infinity	10,000	70	78	83	79	
9—16	Infinity—	9,000	Infinity—	9,000	Infinity—	9,000	82	82	98	81.5	
9—23	Infinity—	10,000	Infinity—	10,000	Infinity—	10,000	67	68	80	62.5	
9—30	Infinity—	10,000	Infinity—	10,000	Infinity—	10,000	74	75	90	76	
10— 8	Infinity—	8,000	Infinity—	8,000	Infinity—	10,000	66	67	80	65	
10—15	Infinity—	10,000	Infinity—	10,000	Infinity—	10,000	..	60	83	65	
10—21	Infinity	Infinity—	Infinity	8,000—	Infinity	Infinity—	..	..	..	64	Y-phase reactance coil burned out. Test down for 93 hours.
10—28	Infinity—	9,000	Infinity—	9,000	Infinity—	9,000	71	70	81	74	
11— 4	Infinity—	10,000	Infinity—	10,000	Infinity—	10,000	61	61	77	58	
11—11	10,000	8,000	10,000	8,000	10,000	8,000	62	62	80	62	
11—18	Infinity—	10,000	Infinity—	10,000	10,000	10,000	57	58	70	52	
11—25	Infinity—	10,000	Infinity—	10,000	Infinity—	10,000	61	61	74	56	
12— 2	Infinity	10,000	Infinity	10,000	Infinity	10,000	65	63	90	52	Y-phase reactance coil burned out. Test down for 91 hours.
12— 9	Infinity—	10,000	Infinity—	100,000	Infinity—	100,000	53	53	66	48	
12—16	Infinity—	10,000	Infinity—	10,000	Infinity—	100,000	59	60	75	57	
12—23	Infinity	10,000	Infinity	10,000	Infinity	100,000	56	56	63	44	
12—30	Infinity—	10,000	Infinity—	10,000	Infinity—	100,000	60	60	69	52	
1928											
1— 6	Infinity	10,000	Infinity	10,000	Infinity	10,000	55	55	70	50.5	
1—13	Infinity—	10,000	Infinity—	10,000	Infinity—	10,000	60	60	78	58	
1—20	Infinity—	10,000	Infinity—	10,000	Infinity—	10,000	55	56	67	50	
1—27	Infinity—	10,000	Infinity—	10,000	Infinity—	10,000	59	59	69	48	
2— 3	Infinity—	Infinity—	Infinity—	Infinity—	Infinity—	Infinity—	53	53	69	50	
2—10	Infinity—	Infinity—	Infinity—	Infinity—	Infinity—	Infinity	58	58	67	49	
2—17	Infinity—	Infinity—	Infinity—	Infinity—	Infinity—	Infinity	53	53	66	50	
2—24	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	50	50	56	49.5	1,000-meghom megger used
3— 3	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	53	53	66	45	1,000-megohm megger used
3— 9	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	..	..	..	..	1,000-megohm megger used*
3—16	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	58	60	68	No. ther.	1,000-megohm megger used
—23	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	62	62	77	60.5	1,000-megohm megger used
—30	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	55	55	55	47	1,000-megohm megger used
— 6	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	69	69	84	69	1,000-megohm megger used
—13	Infinity	Infinity	Infinity	Infinity	Infinity	Infinity	63	63	75	60	1,000-megohm megger used
—21	100,000	70,000	10,000	7,000	10,000	3,000	66	66	71	45	
—28	Infinity—	10,000	10,000	10,000	10,000	4,000	68	68	79	58	
— 4	Infinity	Infinity	Infinity—	Infinity	Infinity—	1,000 ohms	78	78	93	78	1,000-megohm megger used*

*Joint being installed on additional test

presence of moisture except in that portion of the outer tape of one conductor which was in contact with the wet filler.

Upon removal of the sheath from the second piece of cable a wet area was revealed on the belt about 3 in. wide and extending a little less than half way around. Another discolored and wet area of about 1 sq.in. showed itself 5 in. away and was caused by a hole in the lead, which appeared to have been inadvertently made at the time of the fitting of the "belt" thermocouple, due to a faulty wipe. This smaller area decreased as the belt tapes were removed, until at the ninth layer the moisture disappeared. The belt tapes under the hole in the sheath tested wet through to the filler. One of the latter showed the presence of moisture for a distance of about 2 in. from the hole.

Thirty-five of the 64 tapes of the insulation of the conductor located under the wet belt area were penetrated by the water. The outer layer was affected for 2 sq.in., but the area diminished to a small spot on the 35th tape.

As in the first piece of cable, the hole in the sheath had also penetrated seven of the belt layers in the third piece. The area affected by the water was 4 in. wide and extended about half way around the belt. The penetration showed through the belt insulation to the innermost 30th layer, where the wet region was only 3x2 in. in area. As before, only the lateral filler under the hole was wet, but due, no doubt, to a more loose construction of the cable at this point the moisture had traveled both ways along the filler for a total distance of 12 in. In so doing it had penetrated for two layers a similar length of that part of the conductor insulation lying against the filler. As the tapes were removed on this conductor the area diminished until, at the fifteenth layer, but three adjacent tapes located under the hole were affected. Forty-eight of a total of 64 layers tested dry.

Another conductor of this sample was similarly affected by the longitudinal seepage of the water, but only one layer was affected for the length of the sample. Thirty of the 63 layers of insulation of this conductor were penetrated in the region of the test hole. The third conductor was not affected.

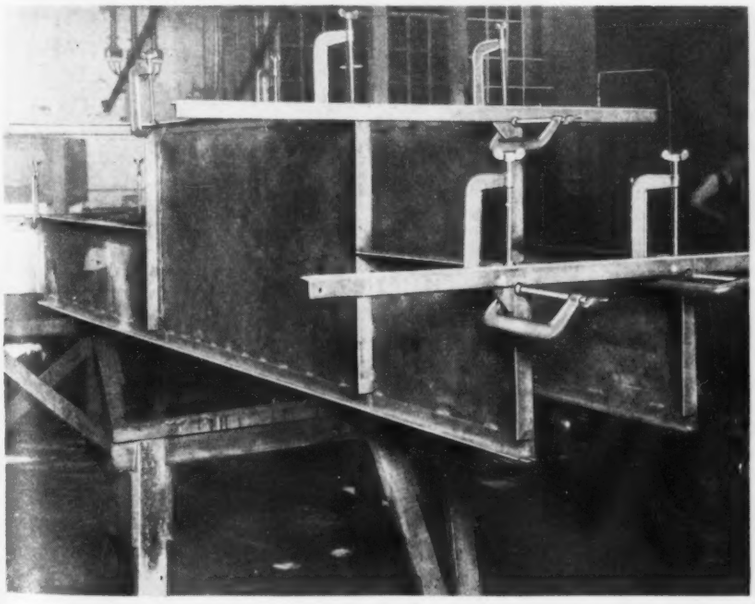
During these examinations some very interesting specimens of the early stages of dendritic formation were uncovered. The tree design was most pronounced, extending throughout the cable, but an uncommon feature was that in no case was a black or dark color found, indicating the presence of carbon, generally associated with it. The size of the design varied, but with no apparent relationship to its location in the cable or to the field strength impressed upon it. In the accompanying illustration can be seen the type of formation found and shows the tapes penetrated by the current path of the faulty conductor. It also reveals very clearly the watermark in those tapes affected by the moisture penetration. No trace of wax or carbon was found in any part of the cable during the examination.

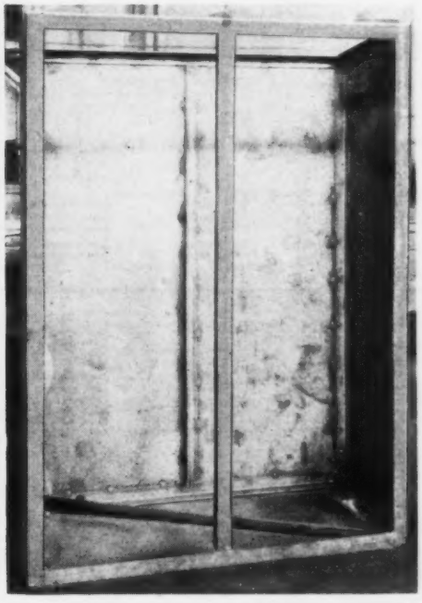
Favors Steel Switch Cells

By J. W. Young and E. J. Clark
Formerly with Byllesby Engineering & Management Corporation

STEEL cells of properly chosen structural shapes and sections combine extreme strength with light weight. Steel is also advantageous in this use because it is elastic and will largely absorb shocks and vibrations such as accompany the operations of oil circuit breakers. An important incidental advantage of using steel cells is that the weight of the oil circuit breaker installation is considerably reduced over cells using masonry construction. Consequently, with high-voltage units particularly, floor loadings may be reduced and building construction lightened because of the decreased weight.

The welding process is particularly adapted to the assembly of steel cells. Detailing of the various members is simplified and the elimination of protruding bolts and





Welded switch compartments

In fabrication, the cross angles are held by clamps which are bolted when the compartment is assembled on the job. No. 12 gage sheet steel is used with $\frac{3}{4}$x2x2-in. angles.

The combined punch and shearing machine punches holes up to $\frac{7}{8}$ in. diameter in $\frac{1}{2}$-in. plates and shears steel to $\frac{1}{2}$ in. thick and $\frac{3}{8}$x4x4-in. angles.

rivet heads aids in maintaining clearances and furnishes an over-all smooth and neat appearance. With attention to bracing and the covering sheets, the structure may be self-supporting and may be anchored to the floor without other support, such as a rear wall or adjacent cells.

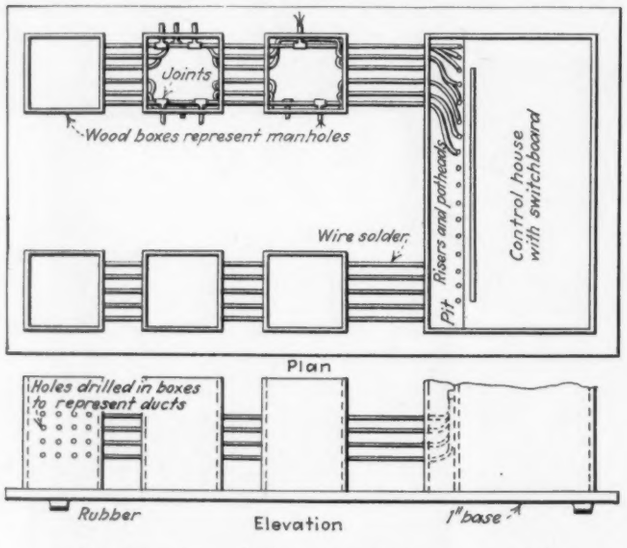
Another advantage of a unit-type cell of this nature is its high salvage value. Practically the entire structure, including the oil circuit breaker, may be removed for installation and use at another location if required. Also it is possible to accommodate other types of oil circuit breakers in the same cell structure by changing a small amount of mounting steel work.

The steel structure does not present any particular difficulties from an electrical standpoint. The cell must be amply grounded in accordance with prevailing practice and sufficient clearances maintained as with any structure. In general, it may be said that operating considerations for truck-type switching units apply to an installation of this nature in so far as the use of steel is concerned.

Wooden Model Aids Construction of Underground System

By John S. Isdale
Meriden, Conn.

A DISTRIBUTION system in which lead-covered cables were to be laid through clay ducts had to be arranged so that certain cables would be in definite positions at particular manholes. To insure a neat and accurate job, models on a scale of 1 in. per foot were made in wood to represent the manholes, holes being drilled in the sides to represent ducts and conduit. Wire solder was threaded through the holes to simulate the cables and colored threads were run spirally along the solder where tracers were needed. Rough outlines in wood were cut on a bandsaw to represent joint boxes

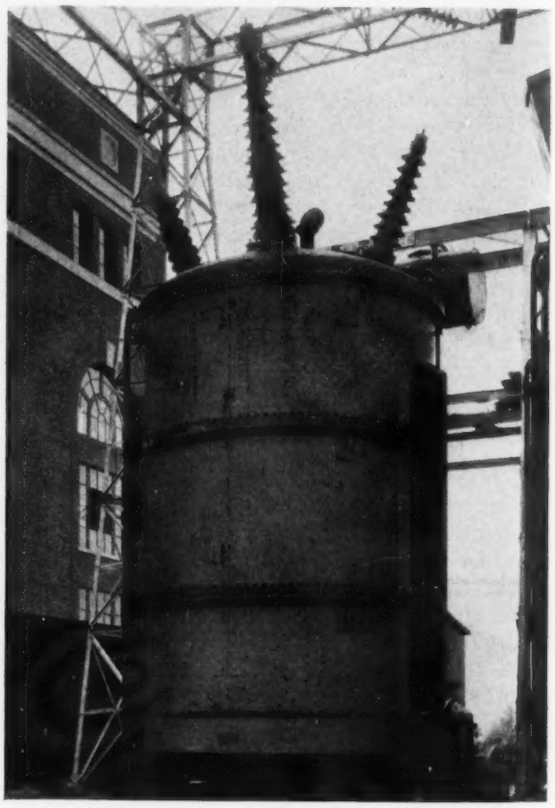


Sketch of manhole and cable layout model

and potheads, holes being bored in the end to receive the wire solder. By this means the system was laid out in miniature and could readily be understood without reference to complicated drawings; cable rests and bends were planned ahead and all concerned knew how the finished job would look.

Unusually Large Transformers for Leaside Station

TRANSFORMERS with three windings, each of 15,000 kva. capacity, and equivalent to an ordinary two-winding transformer of a capacity of 22,500 kva. at 25 cycles, have been supplied by the Canadian Westinghouse Company for the Leaside station of the Hydro-Electric Power Commission of Ontario. These transformers will form the connecting link between the 220-000-volt, 230-mile Gatineau-Leaside transmission



Tap-changing transformers of Ontario Hydro commission establish records for size

line, the Niagara transmission system using 112,500 volts and the Toronto Hydro system with 13,200 volts. They are said to have the largest physical dimension of any transformers so far built in Canada. A floor space of 13½ ft. x 20 ft. is required and the distance from floor line to the top of the high-voltage bushing is 34 ft. Their total weight is 184 tons. There will be seven of them installed eventually.

Each transformer is equipped with tap changers by means of which the voltage may be regulated 7½ per cent above or below normal on the 112,500-volt winding, without disconnecting the transformer from the circuit. In addition, each transformer is equipped with many temperature and protective devices, which constantly keep the operators informed as to the condition of the temperature of the oil, windings and other parts of the transformer, and in the event of any trouble automatically disconnect the transformer from the line. Each of these large transformers requires 14,500 gal. of oil. In order to keep the transformers at safe working temperature each unit requires 75 gal. of water per minute, or 108,000 gal. every 24 hours.

Recommendations for

Electric Water Heating*

Results of two-year study of American and European practices indicate value of low-wattage, high-storage-capacity domestic water heater. Test data and conclusions

A CAREFUL investigation of the general subject of electric domestic water heating as a consumer of off-peak energy has been conducted during the past two years by the electric water heating committee of the Empire State Gas and Electric Association. Numerous tests in customers' homes have been studied and the results consolidated.

In the opinion of the committee, European practice is well ahead of American practice in meeting the problem of filling up the valleys in the load curves without adding to plant investment. This has been achieved abroad largely through water heating and to some extent with house heating. The progress made overseas is attributed largely to the use of two-rate and three-rate meters. European customers understand the peak problems of their utilities and are educated to the difference between cheap night energy and costly peak energy. The possibilities of large capacities of several hundred gallons using off-peak service entirely have been fully developed in some Old World cities. The value of this load is obvious, even though it uses extra transformer and service equipment as contrasted with domestic on-peak heating. The load factor until recently was 22 per cent in Paris. It is 70 per cent in some Swiss cities.

Changed Practices Recommended

The committee has departed from national precedents in many particulars because it has confined the studies to off-peak types of heaters. It is accepted that in the future there will be little justification for the large-unit, small-tank equipment.

"Every power executive knows that the time of day that the load is used is all-important and that the problem is to distribute the peak load over other parts of the 24 hours," the report states, "yet most rates are not now based on this fundamental. Rather than unduly build the day-time domestic peak load and deepen the off-peak valleys, what we need is to keep down the investment and fixed charges by filling in a new night load. This night load produces a greater per cent of net profit than any peak load, because the expenses incident thereto are negligible. Load factor improvement is the surest way to build up net and meet the problem of more kilowatt-hours per customer as well. What makes the low-wattage systems attractive to the public utility with surplus current to sell is the characteristic slow recuperation and low demand. Desirable as is quick pick-up of temperature to the user, what constitutes an ideal solution is a compromise between quick recuperation and night operation."

After a considerable number of tests using 50- and 60-gal. insulated tanks and 1,000- to 1,500-watt elements, it was found that an average of one-third night-time use could be realized without time clocks. In other words, it is possible without cutting off and preventing use of current during the day to have monthly off-peak use of about 150 kw.-hr. and 300 kw.-hr. day-time use. Rate structures can be safely set up on this basis for this type of installation. It is better, however, to use a two-rate meter with a time switch as part of the meter and pass all cooking, heating and refrigeration current through this meter.

Characteristics of Low-Wattage Heaters

The principal shortcoming in the low-wattage, large-storage type is encountered on washday, or one day in seven. Where the requirements of a family have not been accurately diagnosed and a storage system has to be supplied for additional heat during the day, either a booster or a small kitchen heater must be provided as an auxiliary, or provision made for turning on the current during the day. It is believed that a small booster tank in the kitchen with a 1,000- to 1,500-watt element can be marketed effectually at not over $25 with intermittent or thermostatic control. This meets the washday emergency at a day rate and still allows for use of a storage system on a night basis.

One of the real problems in this type of water heating is "liming." Where water characteristics are not good, it is a vital matter to use a type of heater construction and thermostat setting that will prevent "liming." There is no foundation to the claim that only 3-kw. to 5-kw. elements can prevent lime deposits.

Accessibility of electrical connections and ease of removing heater unit are essential. The committee favors the visible adjustable thermostat rather than fixed factory settings that service men cannot alter on the job. Insulation must be thick enough for efficiency, and while 2½ in. is enough, the committee prefers 3 in. or more. There is a marked difference in the kind of insulating material used.

Objection to low-wattage heaters on the ground that it takes a considerable length of time to heat a large tank from a cold condition has been made. The committee states that based on a 100 deg. temperature rise, 7½ hours is required for a 1-kw., 32-gal. outfit, ten hours for a 550-watt., 60-gal. outfit and fifteen hours for a 1-kw., 60-gal. system. In actual practice it is seldom necessary to heat a tank from the cold condition, since the average raise is between 50 and 60 deg., thus reducing the heating period as given by at least one-third.

A large number of installations of low-wattage equipment will average from 50 to 60 per cent. off-peak and

**As made in the annual report of the committee on electric water heating, H. C. Wilder, chairman, Empire State Gas and Electric Association, 1928.*

many of them will show 70 per cent night-time use without clocks. In attacking the problem of off-peak service, it will have to be assumed that families using more than 70 gal. per day, which represents a minority of our prospects, can be taken care of with elements larger than 1,500 watts and in conjunction with booster installations without greatly increasing wiring costs. In large installations relatively less off-peak current can be used, due to the higher wattage and smaller hours of current use. This class of large consumers is not of primary interest in such considerations.

Installation Cost Established

The 1,000- to 1,500-watt heater with 40- to 60-gal. insulated tank can be installed, including wiring and piping, for $12 to $15 and should be sold by the company or dealer at a price to include installation. The committee states that a two-wire, 110-volt circuit can be universally used for water heating instead of three-wire, 220-volt as at present. Voltage, however, is not all important and may be adjusted to central-station policy. Wiring costs are low as compared to 3-kw. to 5-kw. heaters, which exceed convenience outlet limitations.

It is obvious that great possibilities are opened up through transferring the use of many appliances to off-peak periods. To gain this objective is a justification for the use of two-rate meters rather than placing time switches on individual appliances, or attempting to average the night-time and day-time use in one average rate structure. The additional revenue from domestic water heaters will pay for the company's investment in the two-rate meter and contact clock in six months. There is no good reason for charging a customer for two-rate metering apparatus, although a minimum charge of $3 or $4 is advisable. The additional cost of the two-rate meter will be about $30 above the existing meters. Time switches can be bought for $12 to $16.50, and it is stated that it seems reasonable that any power system can afford to furnish one such device in a customer's home to gain revenue which is largely net.

Committee Recommendations

Domestic electric water heating must be off-peak, low-wattage storage type to justify low rates needed for volume sales.

Fifty to 75-gal. tanks—3-in. insulation—1,000- to 1,500-watt elements ideal.

Avoids high wiring costs of 3-kw.-5-kw. tanks. Two-wire, 110-volt supply can be used.

Upkeep and servicing negligible.

First cost $175 or less installed.

Radiation losses offset by off-peak advantages.

Monthly use from 300 to 600 kw.-hr. without increase in plant or service equipment.

Thermostatic failure not serious.

Two-rate meter recommended.

More kilowatt-hours use without increase in fixed charges.

Practically no day-time peaks produced.

Excellent power-factor and load-factor characteristics.

All the tests which have been made demonstrate that water heating can never be had in volume on rates above 2 cents, with the exception of intermittent water heating. In this connection it is necessary to appreciate the great load possibilities offered without increase in plant investment. Tests have demonstrated that automatic storage water heating consumes an average of 300 to 400 kw.-hr. a month. Whether all of this or one-third of this falls during off-peak hours depends on the water-heating requirements of the family, type of equipment used and other considerations referred to above. No water heating can be recommended to a customer which will cost him more than 6 mills per gallon to operate. This load should not be attempted unless the rate is 3 cents or less.

Flat rates of $36 to $40 per kilowatt are feasible with low-wattage controlled heaters, whereas flat rates are highly dangerous with 3-kw. to 5-kw. jobs. This is stated to be true in the West, where flat rates for water heating are in force but difficult to change to meter rates. Flat rates are not recommended, but with this type of equipment use can be reasonably controlled.

Study of farm hot water requirements reveals a field that is attractive because rural load has to be built up rapidly to make rural lines profitable. Too many of these lines are unprofitable today. Electric water heating seems to offer an especially desirable load on rural lines. Most of these lines are of comparatively small capacity and are single phase. Many low-demand water heaters could be added to these lines without in any way overloading them. Aside from refrigeration, there is practically no night load on rural lines.

To show correctly what the water heating load is worth the average residential consumption of five Northwest power stations for 1927 follows:

	Kilowatt-Hours
Washington Water Power Company	1,676
California-Oregon Power Company	1,423
Idaho Power Company	1,152
Northwestern Electric Company	938
Portland Electric Power Company	840

Comparative Tests, Electric Water Heaters

Test No.	M-A	M-B	M-C	M-D	712 M	ABM	713 W	51	B	10
Control	Relay	Relay	Time clock	Part Time clock	2 Thermostat	Two-Rate Meter	2 Thermostat and time clock	Thermostat	Time clock	2 Thermostat
Size of tank	60 gal.	2-60 gal.	2-60 gal.	2-60 gal.	40	40	60	30	2–30	60
Size of unit	1,500	2,000	2,000	2,000	600 and 700	1,500	1,500	1,000	1,000	1,500
Persons served	4	4	4	4	9	7	5	4	4	5
Faucets	4	4	4	4	3	5	7	5	5	7
Duration, days	4	5½	5.85	12.6	37	16	17	28	14	39
Water heated, gallons	273	414	411	1,035	2,300	857	1,580	1,562	892	3,397
Average temperature rise	104	100	89	83	80	103	89	90	74	102
Kilowatt-hours used	80.5	131.7	114	283.9	602	250	293	462	197	1,040
Kilowatt-hours per gallon	0.294	0.318	0.277	0.274	0.261	0.285	.....	0.295	0.221	0.306
Average kilowatt-hours per day	20.1	25.3	19.5	22.4	16.26	16	17.23	16.5	14.1	26.7
Average gallons per person per day	17	19.9	17.5	20.5	7	7.7	18.6	13.95	15.9	17.4
Per cent off-peak	65	81	100	75	.....	40	90	60	83.8	40

At the time the committee started its tests very little low-wattage equipment could be obtained except on special order from the manufacturers. Since these tests and research have been in progress, at least ten manufacturers have brought out equipment making possible the use of all or part off-peak current. As the demand for this equipment increases it is evident that quantity production will result, so that the first cost will no longer be a factor to prevent general application. The cost installed must be kept below $175 on the average.

Much has been said about proper temperatures for thermostats to operate. In most localities it is concluded that 145 deg. is best maximum and 115 deg. proper minimum, and that settings should be made accordingly. Higher temperatures than 145 deg. virtually increase tank capacities and avoid washday troubles, but may lead to "liming" in towns where water conditions are bad. If all the tests made in this investigation had been at the 115 to 145 deg. range much greater economies would be shown, but these tests were made under heavy demand conditions in most cases. In the last analysis, thermostatic settings have to be determined locally and individually to suit the family's requirements.

Installation Costs Minimized on Street-Lighting Job

By L. E. Weber
Home Electric Light & Steam Heating Company, Tyrone, Pa.

A SYSTEM of boulevard lighting was recently installed by the Borough Council of Tyrone, Pa., acting on a petition presented by citizens and containing the names of 50 per cent of the property owners and foot-frontage of the sections involved. The owners agreed to pay two-thirds of the cost if the borough assumed the remaining installation charge.

The system laid out included all principal streets which were to be improved in the near future and particular reference was given to length of circuits and transformer control centers. Where possible, the transformer (type "RO") for each circuit was placed adjacent to the transformer supplying the adjoining circuit so that a temporary jumper could be used in case of failure of supply to either circuit.

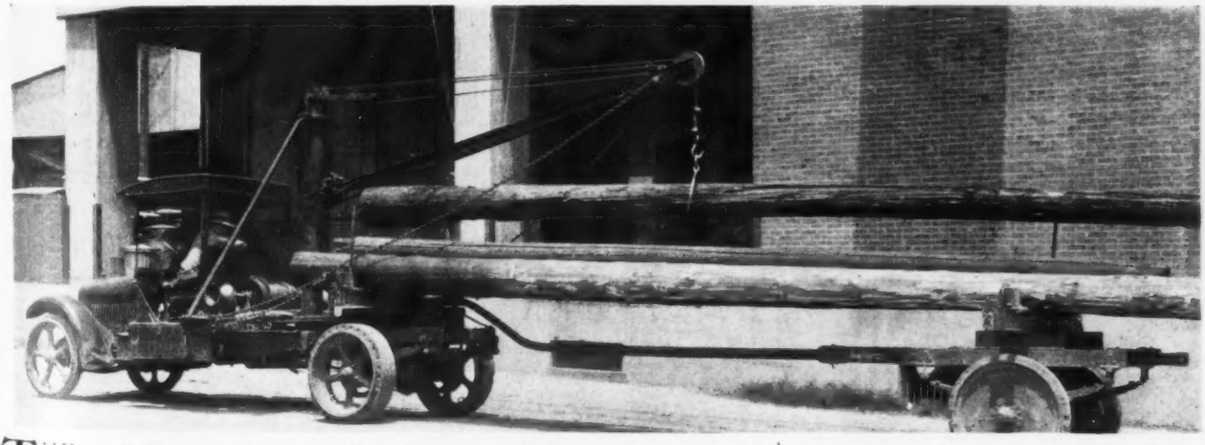
Single-conductor parkway cable was laid in the street adjacent to the curb. On paved streets a 4-in. trough was made by removing a half brick and then refilling with concrete. On concrete streets a smaller trough was made and refilled with concrete or cold patch according to conditions. When the ground contained cinders a layer of shale was first thrown in the trough and the cable laid on top. The cable was protected at street crossings, sewers and trees by galvanized pipe. The cable passed through drilled holes in the curb into sheet metal bends formed in the concrete base, terminated and grounded at disconnecting potheads. A light wooden frame was used to support the foundation bolts and pothead bracket while the concrete base was being poured.

Union Metal fluted steel shaft standards were selected on account of safety and simplicity of repairs in case of damage. The lighting unit consisted of a light alabaster glove with an asymmetric dome refractor. For business districts a 400-cp. lamp was used and in residential districts a 250-cp. lamp was placed in the "Novalux" unit. Also in residential districts an asymmetric dome refractor was used which redirected a majority of the light from the house side to the street.

The standards were placed diagonally along the street with a spacing of 42 to 60 ft. in business districts and 65 to 90 ft. between light centers in residential districts. At important business centers a standard was placed on each side, 15 ft. from the corner, making a total of eight standards within the radius of the intersection. The system was planned for present and future needs when larger candlepower units would be required. In some cases electrically operated mushroom traffic lights were fed and controlled from the boulevard system by means of subway (type "IL") transformers.

By means of close co-operation with contributing companies the borough engineer kept the cost to the property owners in business districts to $1.40 a front foot and $0.96 a front foot in residential districts, the cost being proportioned to the number of standards.

Pole-Handling Equipment



THE truck illustrated above, which is rated at 2½ tons, is used to haul poles to and from the pole yard by the Dallas Power & Light Company. Cable from the truck winches is threaded through the arm of the boom and attached to a pair of grab hooks used for hoisting poles. With its emergency trailer and loading device this White truck is able to handle all sizes of poles, whether they be taken from the pole yard or removed from service, according to John Oram, chief engineer of the company.

Department Efficiency Increased by Competitive Plan

By F. H. Rogers
Meter Department
Consolidated Gas, Electric Light & Power Company, Baltimore, Md.

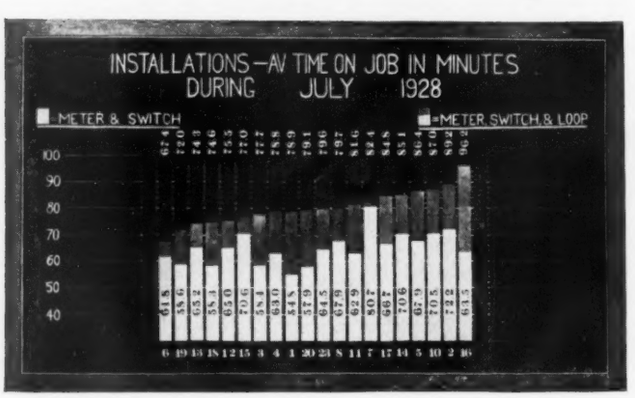
SOME months ago we endeavored to find a way to reduce operating costs by minimizing the time required per job for the installation and testing of meters on customers' premises. The nature of the work makes it impractical to maintain any close supervision of the men, so the plan of showing on a blackboard the relative speed of each crew was tried in order to stimulate competition and to furnish an incentive. Each man was to know that his position on the chart would be given weight when adjusting wages.

This plan was easily applied to the testers, for their work is uniform. By dividing them into groups of small alternating-current meter testers (testing meters up to the 25-amp. sizes), large alternating-current meter testers (including polyphase meters), and direct-current meter testers, we were able to compare the average number of meters tested by each man per day, over the period of a month, with the work of the others in his group. To make the comparison fair, eight hours was considered a day, and only the time that was actually chargeable to testing the meters falling in a particular group was considered.

Adapting Plan to Varied Nature of Work

The daily average for each group as a whole over a period of the past three months is calculated and the positions of all testers having monthly averages above the three-month daily average of their group are shown by white columns; all those below the group average are shown in red. Instead of the men's name appearing on the chart, code numbers are used, each man being told only his own number.

In adapting this idea to the work of the installers,

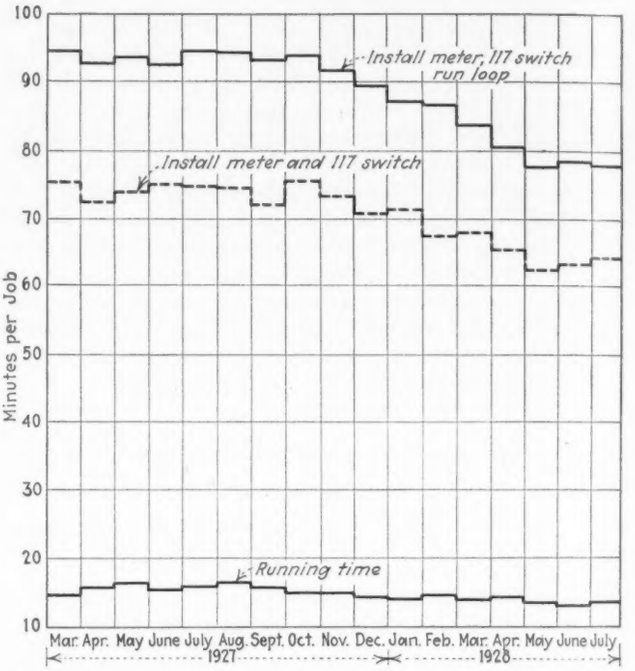


Efficiency of meter men compared on shop bulletin board leads to improvement

Vertical divisions represent minutes per job. The figures at the bottom of each column are code numbers for each test crew. Average time requirements are indicated in the columns.

certain difficulties arose because the nature of their work is more varied, the duties being to install, change or remove all metering and service equipment on customers' premises, to run service loops and to cut in or cut out service; also, since each crew customarily works in an approximately given territory, cognizance must be taken of conditions peculiar to the different sections, notably the fact that a crew working in a suburban territory has a considerably longer run between jobs than one working in the heart of the city.

The method used was to require each crew to keep a log of its work showing, among other things, the location and nature of each job and the time of arrival and departure. For the purpose of the chart, two typical



Departmental averages of time required for installations shows marked decrease

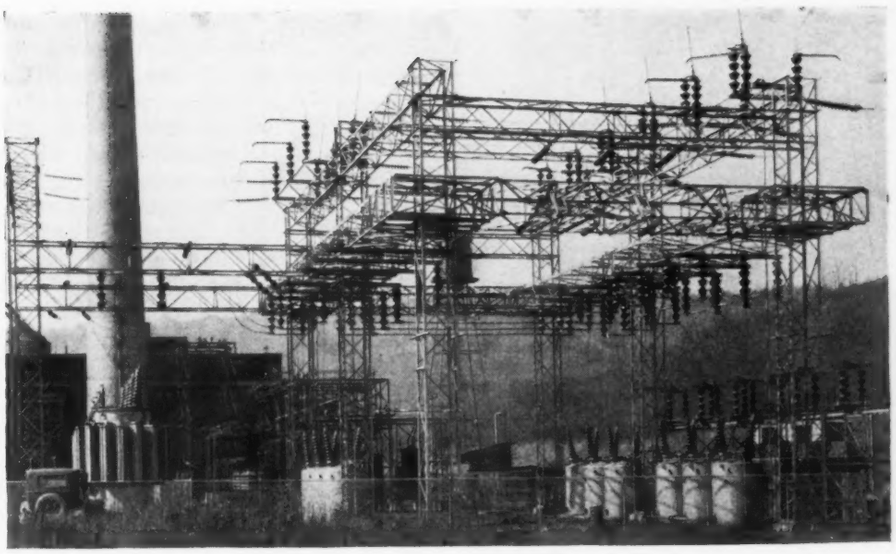
kinds of jobs are analyzed: (1) Installing a meter and a 30-amp. switch, and (2) installing a meter, 30-amp. switch and running a service loop. The accompanying figure shows how this information is presented.

This method of presentation has several advantages, perhaps the most important of which is that it shows team work. The meter-and-switch job is essentially a one-man job, the lineman having little to do except to assist the meterman by handing him tools and perhaps holding a light, while in performing the meter-switch-loop job the lineman runs the loop while the meterman sets the meter and switch. The time required for running a service loop is about the same as that for setting the meter and switch, so that theoretically the over-all time on both jobs should be the same. Since the shaded portion measures the difference in time on the two jobs, an endeavor is being made to reduce it as much as possible.

Of course, other factors must be considered which cannot be brought out on a chart, but the blackboard has proved a good index of efficiency.

Every three months each crew's average for the past quarter is calculated and plotted. These quarterly charts are kept as permanent records of the work of the various crews.

There has been a marked increase in the number of meters tested per day since the scheme went into effect and a satisfying decrease in the time on installation jobs. Since we test annually on customers' premises about 60,000 meters and install about 20,000, the monetary saving is considerable.



Ridgway station of the Keystone division of the West Penn Power Company

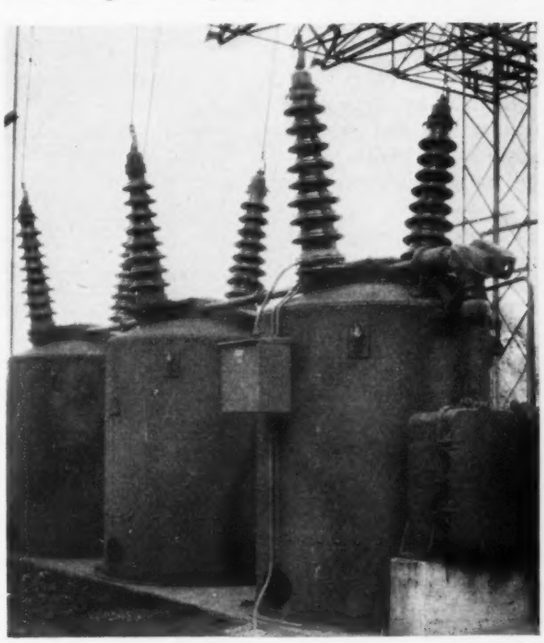
Bushings Supply Potential

Voltage tap to outer metal foil layer of standard condenser bushings permits simplified synchronizing, potential-indicating-and-relaying scheme on West Penn System

By H. A. P. Langstaff* and Paul L. Langguth†

INCREASE of high-voltage interconnections between the West Penn System and other systems has complicated the switching set-up at various points. A simplified synchronizing, potential-indicating-and-relaying scheme is made possible by a voltage tap to the outer metal foil layer of the present standard condenser bushings.‡

The West Penn System and the Pennsylvania Electric System normally operate in parallel at Piney and Warren with connections shown in an accompanying illustration. These systems also tie in with the Niagara, Lockport & Ontario System at Warren via Falconer and points north. The 132-kv. system operates with a solidly grounded neutral at Springdale, Piney and Warren. When feeding Ridgway directly from Springdale independently of Piney or Warren or both, the originally applied relay scheme is less effective. Experience has proved that the greater number of 132-kv. failures are faults to ground. The rocky nature of the country which this section of the system traverses presents high resistance to ground faults. These conditions cause ground fault currents of comparatively small magnitude, necessitating low ground relay settings. The application of directional ground relays best meets these requirements, insuring prompt clearance of ground faults without affecting the functioning of the phase relays, which must be set much higher to take care of normal loads.

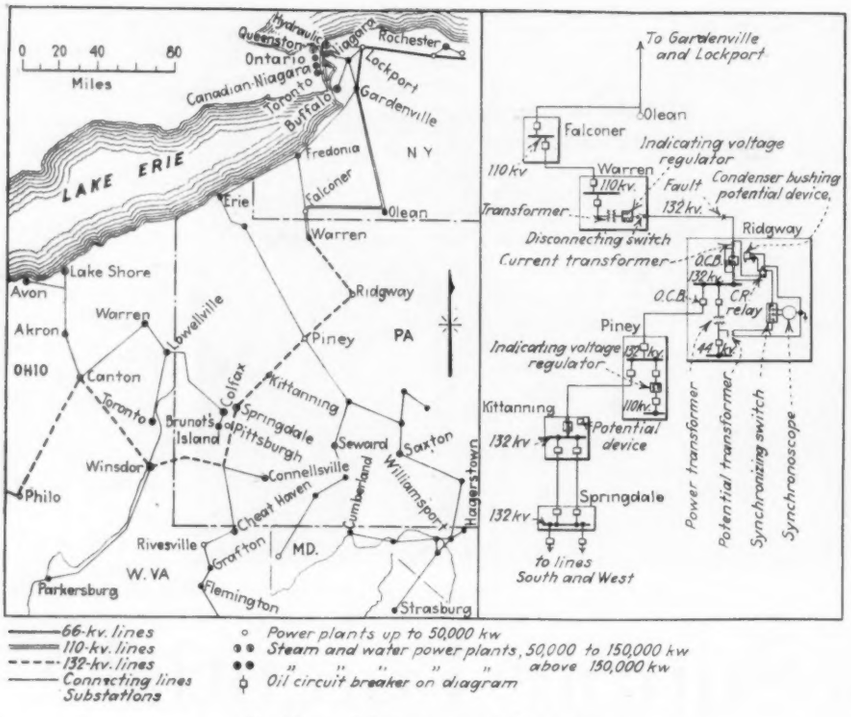


132-kv. G-2 breaker at Ridgway equipped with the condenser-bushing potential device

Potential for ground relays must be taken directly from all three phases, and if potential transformers were installed for this purpose the cost of adequate ground protection would be excessive. The present directional phase relays obtain their potential from the 44-kv. bus, but this source is not suitable for directional ground relaying on the 132-kv. system. The stand-

*West Penn Power Company.
†Westinghouse Electric & Manufacturing Company.

‡*Transactions A.I.E.E., March 1928, "Condenser Type Bushing Used with Synchronizing Equipment," by Messrs. Spracklen, Marshall and Langguth.*



Section of interconnected systems

ard oil circuit breaker condenser bushing equipped with a voltage tap and used in conjunction with an external potential network provides suitable potential for the ground relaying scheme. The burden which can be carried on this device is limited only by the capacity of the bushings to which it is connected and on the higher voltages is entirely adequate for the usual voltmeter, synchronoscope or relay loads. This arrangement has several outstanding advantages as compared with the potential transformers, as follows: (1) It is relatively inexpensive; (2) usually requires no additional space when installed on a circuit breaker; (3) requires practically no maintenance; (4) requires no additional high-tension connections for performing service required.

A scheme using potential from the oil circuit breaker condenser bushing is shown herewith. This arrangement will be used in conjunction with the 132-kv. type G-2 breaker at Ridgway to protect against line and ground faults. The protection is practically identical with usual potential transformer practice and in addition has the above advantages.

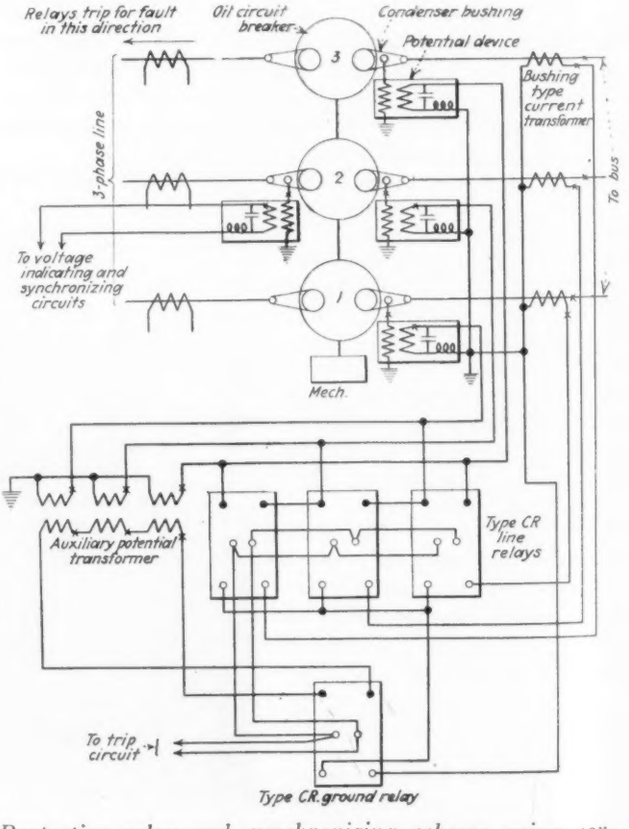
The condenser bushing potential device is being used for synchronizing and voltage indication at Ridgway and at Kittanning. Arrangements have been made to operate the West Penn, Pennsylvania Electric and Niagara, Lockport & Ontario systems in parallel. Previous to this installation, when the systems went out of parallel at Ridgway considerable time was lost due to necessary switching. This difficulty has been eliminated by the use of this potential device, which is also connected to a voltmeter to indicate voltage of the incoming lines at Ridgway previous to synchronizing.

Field Tests

A series of field tests were conducted at Ridgway on April 22, 1928, in order to check the performance of the potential device. The installation was made as shown in an accompanying illustration, with all necessary equipment mounted on the breaker tank.

The relay tests were made using a standard CR relay having its potential element energized from the potential device and the current element from the bushing type current transformer mounted on this same condenser bushing. A high resistance ground connection was made to limit the flow of current by connecting a wire from this one phase to a tree stump. Higher values of ground current were obtained by making solid contact to ground. In every case the fault was cleared by this relay functioning and tripping the breaker. Voltage measurements were taken across the relay under normal operating condition and during the fault, which indicated satisfactory regulation of the potential device.

A system set-up was made in order to check the application of this device for synchronizing purposes. The West Penn and Pennsylvania Electric Company systems were paralleled at Piney and the 132-kv. bus, transformer bank and 44-kv. bus were energized at Ridgway. The Niagara, Lockport & Ontario system energized the Warren line to Ridgway. A standard switchboard type synchroscope was used having the "incoming" element energized from the potential device and the "running" element connected to the 44-kv. potential transformer on the Ridgway bus. The rotation of the scope was observed for a short length of time and the relative speed and



Protective relay and synchronizing scheme using condenser bushing potential device at Ridgway station

points of synchronism of the systems noted. When synchronism was indicated, the line breaker was closed, tying the systems together with no signs of disturbance whatever.

The West Penn Power Company contemplates the installation of ground relay protection on its 132-kv. system and proposes to install more condenser-bushing potential devices where directional ground relays are necessary.

Temporary Overcapacities of Underground Cables

By M. Monlezun
Distribution Engineering Department,
New Orleans Public Service Inc., New Orleans, La.

THROUGH a study of feeder capacities in one of the more heavily loaded cable runs of the New Orleans Public Service Inc. there was developed the method here described for determining the temporary permissible current loadings that may be imposed on a given cable. These overcapacities are expressed in percentages of the normal current rating and are determined by the value of the current carried several hours previous to the addition of load and by the characteristics of the particular cable.

In order to make the information from the chart immediately and more conveniently available for the guidance of those in charge of cable loadings, there has been provided in the New Orleans utility a tabulation from which may be read directly the permissible load for stated periods. This tabulation is reproduced here simply as an example. The values stated in it apply only to the particular cables designated and to no others. The tabulation must be recalculated to apply to any other cables.

South Peters Street Transmission Line

Normal Continuous Rating

Month	Feeders Nos. 1,2,3,4,5,6,13		Feeders Nos. 24,25		Feeder No. 11	
	Amperes per Phase	Kva.	Amperes per Phase	Kva.	Amperes per Phase	Kva.
January	170.0	1945	269.0	3080	218.5	2495
February	170.0	1945	269.0	3080	219.0	2500
March	171.0	1955	270.0	3090	220.0	2515
April	162.5	1857	263.0	3000	218.5	2495
May	158.0	1807	260.0	2975	212.0	2425
June	145.0	1660	250.0	2860	204.0	2335
July	143.0	1635	249.0	2845	204.5	2340
August	143.0	1635	249.0	2845	204.5	2340
September	139.0	1590	246.0	2815	200.0	2290
October	144.0	1647	250.0	2860	203.5	2325
November	153.7	1760	256.5	2930	208.5	2385
December	166.0	1900	266.0	3040	216.0	2470

Permissible Temporary Current Capacities

(Expressed as a Multiple of the Normal Rating)

Feeder Number	Previous % of Normal Rating					Previous % of Normal Rating				
	50	60	70	80	90	50	60	70	80	90
	Duration - 15 Minutes					Duration - 30 Minutes ->				
1,2,3,4,5,6 & 13	2.61	2.44	2.23	1.95	1.57	1.88	1.78	1.65	1.49	1.28
11	2.64	2.46	2.25	1.96	1.58	1.90	1.79	1.66	1.50	1.29
24 & 25	3.06	2.85	2.59	2.24	1.77	2.19	2.06	1.90	1.68	1.40
	Duration - 45 Minutes					Duration - 1 Hour				
1,2,3,4,5,6 & 13	1.56	1.49	1.41	1.30	1.17	1.38	1.33	1.27	1.20	1.11
11	1.58	1.51	1.42	1.31	1.17	1.39	1.34	1.28	1.20	1.11
24 & 25	1.81	1.72	1.60	1.45	1.26	1.59	1.52	1.43	1.32	1.18
	Duration - 1 Hour, 15 Minutes					Duration - 1 Hour, 30 Minutes				
1,2,3,4,5,6 & 13	1.25	1.22	1.18	1.13	1.07	1.16	1.14	1.11	1.08	1.04
11	1.26	1.23	1.18	1.13	1.07	1.17	1.15	1.12	1.08	1.04
24 & 25	1.44	1.39	1.31	1.23	1.13	1.33	1.29	1.23	1.17	1.09
	Duration - 2 Hours					Duration - 2 Hours, 30 Minutes				
1,2,3,4,5,6 & 13	1.04	1.03	1.02	1.02	1.01	—	—	—	—	—
11	1.04	1.04	1.03	1.02	1.01	—	—	—	—	—
24 & 25	1.18	1.15	1.12	1.09	1.05	1.08	1.07	1.05	1.04	1.02

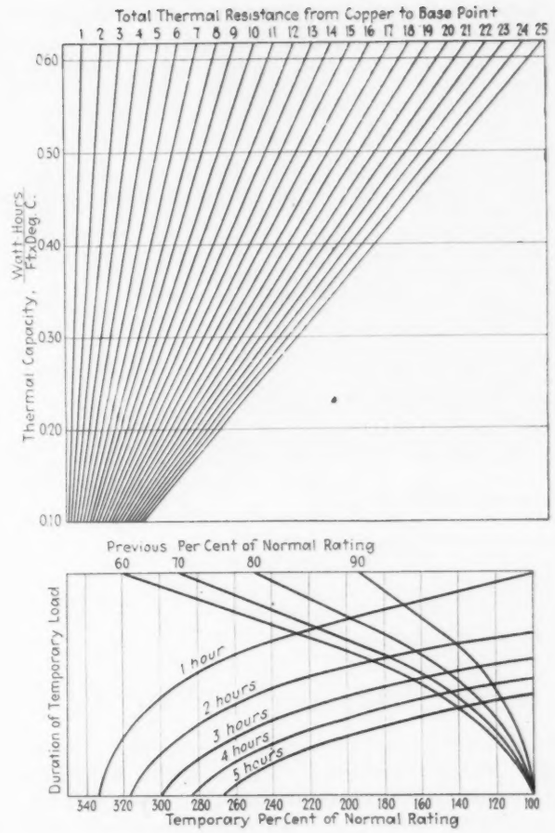
Use of Chart

TOP TABLE. Continuous rating of the feeders for each month of the year is obtained directly from this table.

BOTTOM TABLE. Example of Use. Desired the permissible current that Feeder No. 6 will carry for one hour, during the month of May, the current carried for several hours previously not having exceeded 95 amperes. From the top table the normal current-carrying capacity of this feeder in May is 158 amperes, of which 95 amperes is 60%. In the bottom table under the heading of "Duration - 1 Hour" and "Previous % of Normal Rating" of 60% it will be found that the feeder will safely carry 133% of the Normal Rating, that is, 133% of 158 amperes. The feeder will therefore safely carry 210 amperes per phase or a total capacity of 2400 Kva.

Form of working tabulation derived from graph and used by New Orleans Company

This is not a general table; it applies only to the line designated.


Total Thermal Resistance from Copper to Base Point
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
0.60
0.50
0.40
0.30
0.20
0.10
Thermal Capacity, Watt Hours Ft x Deg. C.
Previous Per Cent of Normal Rating
60 70 80 90
1 hour
2 hours
3 hours
4 hours
5 hours
Duration of Temporary Load
340 320 300 280 260 240 220 200 180 160 140 120 100
Temporary Per Cent of Normal Rating

Graphic determination of temporary current capacities of underground cables

In order to use this chart it is necessary to know the thermal capacity of the cable, (C), in watt-hours per foot per degree Centigrade, the total thermal resistance from copper to a base point, (R_{tb}), the seasonal normal rating of the cable and the percentage of normal load which has been carried for several hours previous to the addition of more load. The curve is entered at the left, a horizontal line corresponding to the thermal capacity, (C), being followed to its intersection with the diagonal line representing the thermal resistance (R_{tb}). A vertical line is then followed down to the curve of time representing the number of hours during which the additional load is to be carried and, from this point of meeting, a horizontal line is carried to the right to intersect the curve of previous percentage of normal rating. The abscissa of this intersection is the percentage of normal rating that may be maintained during the number of hours taken.

The chart is the graphical solution of the formula:

$$K = \sqrt{K_1^2 + (1 - K_1^2)\,\frac{R_{th}C}{h}}$$

which is based entirely on the amount of heat which a cable is capable of absorbing for a given temperature rise. The formula could be refined by taking into account the increase of heat dissipation which follows a temperature rise, but the error caused by the neglect of this factor is small and is on the side of safety and can therefore be overlooked. It has also been assumed that all the additional losses are I^2R losses. This, however, introduces no error because the result of the equation is a per cent ratio of the given datum in which these losses are included.

The derivation of this formula is quite simple:

The copper temperature before the application of a temporary additional load must necessarily be less than the maximum permissible. Under steady conditions, the difference, T, between these two temperatures may be determined by the relation.

$$T = R_{th}(W - W_1) \qquad (1)$$

in which,

R_{th} = the total thermal resistance per foot of cable of the heat path under normal loading condition from the copper to a remote base point,

W_1 = the watts loss per foot of cable that has not been exceeded for several hours previous to the application of the temporary load, and

W = maximum permissible watts loss per foot.

Also,

$$T = \frac{wh}{C}$$

which may be written

$$wh = CT \qquad (2)$$

in which

w = the temporary increment in watts lost per foot of cable,

h = time in hours during which additional losses exist and

C = thermal capacity of the particular cable in watt-hours per foot per degree Centigrade.

Substituting in equation (2) the value of T from equation (1), the following expression is obtained:

$$wh = CR_{th}(W - W_1) \qquad (3)$$

Let I = normal full load current capacity of the cable,

I_1 = current not exceeded for several hours previous to increase,

I_A = allowable current capacity for h hours, and taking

$K = \frac{I_A}{I}$ multiple of normal full load current which may be carried for h hours provided the current for several hours previous has not exceeded K_1 fraction of the same normal full load current, and

$K_1 = \frac{I_1}{I}$ fraction of normal full load current not exceeded for several hours previous.

By taking current values corresponding to the watt losses and reducing them to fractions of normal full load current, the formula from which the graph is drawn may be obtained.

Taking watts loss equal to I^2R, equation (3) becomes

$$(I_A^2R - I_1^2R)h = CR_{th}(I^2R - I_1^2R)$$

which, divided by R, is

$$(I_A^2 - I_1^2)h = CR_{th}(I^2 - I_1^2)$$

Dividing through by I^2h and substituting values for K and K_1 gives

$$K^2 - K_1^2 = \frac{CR_{th}}{h}(1 - K_1^2)$$

from which,

$$K = \sqrt{K^2 + (1 - K_1^2)\frac{CR_{th}}{h}}$$

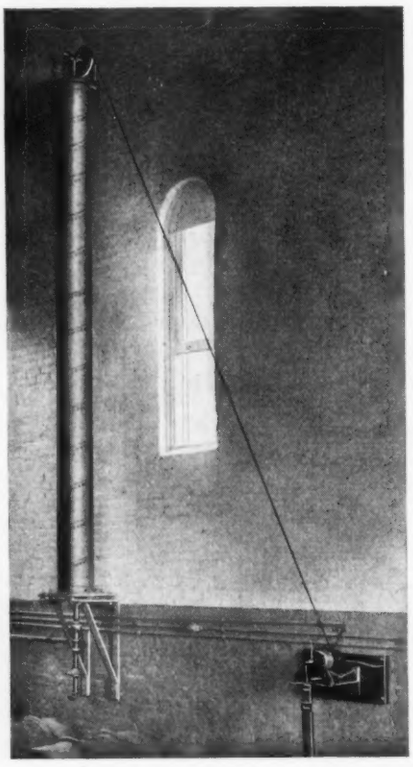
Remote Indication of Water Level

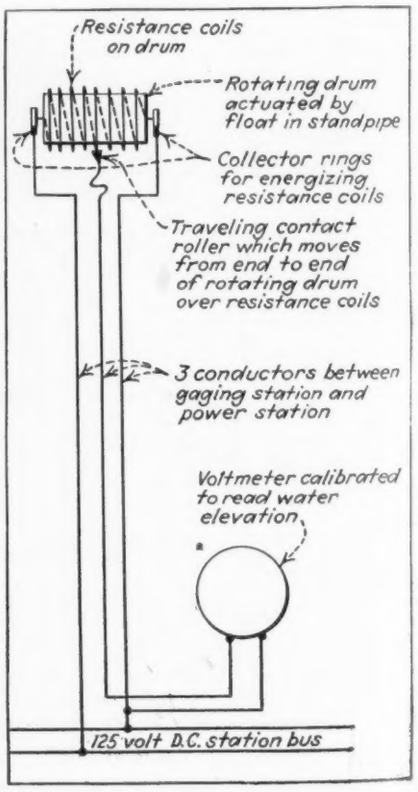
IN A New England hydro-electric plant having a switchboard 350 ft. distant from a water gaging device and 50 ft. lower in elevation, the operator can observe the level of the water in the head canal without leaving the board by the use of the following scheme:

In a transformer house near the head race is located a 1-in. standpipe 12 ft. high, which is always filled with water at canal level except when a shut-off valve is closed during extreme high water periods. In the standpipe is a 10-in. ball float connected by a light chain and piano wire to a drum extension from which a 6-in. x 6-in. insulated cylinder is rotated by the rise and fall of the float. Resistance wire is wound around the cylinder and connected by collector rings across a 125-volt direct-current circuit supplying about 0.5 amp. The switchboard carries a 125-volt, direct-current voltmeter calibrated to read in feet and tenths. From this voltmeter one wire is run to the transformer house before mentioned and one wire is connected to one side of the direct-current circuit supplying energy to the resistance on the insulated drum, and on the other side to a movable arm with a contactor roller which travels over the spiral resistance wire as the standpipe float, in changing its level, causes the insulated drum to rotate. The direct current from the power station to the recording device in the transformer station is carried on a three-conductor underground cable, one wire for the voltmeter, one for the permanent resistance and one common to both. The voltmeter was purchased with a blank scale and calibrated locally.

When the float is at such a level as to cause the contactor roller, which is connected to one voltmeter lead, to cut out all the resistance of the spiral, the voltmeter reads 0 volts or elevation 596.2 ft., the lowest head ever used. When the float is at such a level as to cause the contactor roller to cut in all the resistance, then the voltmeter reads 125 volts or elevation 604.0 ft. A miniature vertical gage of approximately one-third scale is located at the end of the measuring device for local observation.

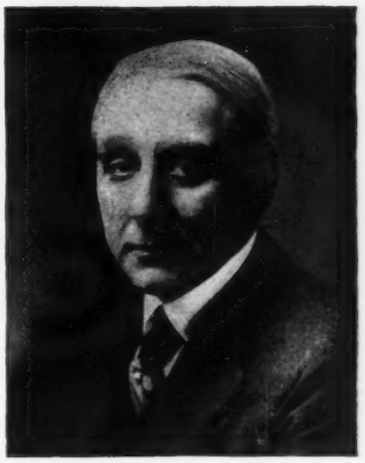
This device has been in use for two or three years and has been a great deal of assistance.




Resistance coils on drum
Rotating drum actuated by float in standpipe
Collector rings for energizing resistance coils
Traveling contact roller which moves from end to end of rotating drum over resistance coils
3 conductors between gaging station and power station
Voltmeter calibrated to read water elevation
125 volt D.C. station bus

Connections of head water indicator and standpipe and transmitting device

Necessity for
Public Understanding



Martin J. Insull

Three essentials for utility progress are good service, fair rates and public understanding. The biggest job that now confronts us is the achievement of the third

By MARTIN J. INSULL
President Middle West Utilities Company

GOOD service at the lowest prices consistent with good business judgment is both the foundation and the goal for the successful public utility company. Upon that foundation the great structure of the electric industry has been patiently reared; toward that goal moves the astonishing but natural development of the industry to a degree which will, it seems, tax popular comprehension.

From a purely selfish viewpoint it is assuredly as important to the public itself as to the electric light and power industry that the public have a full understanding of the circumstances which brought the industry to its present complex state. That importance the industry has long recognized. Official cognizance of the necessity was taken by the National Electric Light Association as early as 1920, when a formal and definite program of public information was embraced by the association.

That program has been the subject of much talk and some criticism in recent months, but it was undertaken as a duty. It is as much a duty as giving good service and charging fair rates. That it was conceived subsequent to these two other basic duties of the business is no reflection on its importance, but rather a recognition coming with the great growth of the business. That its principal criticism has come from not wholly unprejudiced sources is a tribute to the success with which this work of informing the public has been carried on.

Mistakes have been made, of course. The utility industry is a human institution. But it has maintained a record of good faith kept in public service which will never seriously suffer in comparison with other records in public service. It is quite as conscious of these mistakes as those who seize upon them as possible stepping-stones to the realization of personal ambitions.

Bearing in mind that the "disclosures" of the past six months are but background for promised "revelations" to come, it may not be amiss to call attention to the fact that the electric industry, in the very public information activities which have been attacked, long since told the same story. In 1925 the industry announced to the nation in the public policy report of the National Electric Light Association that, "with the increasing popularity of utility securities, it is hardly to be hoped that the industry can entirely avoid there being injected into its development, by some who use its popularity for their financial advancement, financial practices which we should be the first to criticise." That warning, made in the public's interest quite as much as in the industry's interest, was sounded by men jealously proud of the integrity with which the industry as a whole was financed and administered; men who know that any industry not honestly financed and administered cannot endure and, therefore, selfishly anxious to protect their great industry and the public from such practices.

But endurance is not all. There must be growth commensurate with public demand. In the rise of national civilization and culture the electric industry has become an economic and social necessity in the development of modern progress. The industry cannot grow at the pace demanded of it unless its economies, conveniences and comforts have, besides common acceptance, universal appreciation. Of the two, appreciation, which can result only from a broader understanding, is the more vital. This understanding will mean a public attitude that permits the industry to run along smoothly in the individual communities, in the separate states and in the nation. The public's true concern for the electric utilities is that they may continue to develop and expand so that they are able to meet all the demands for service made upon them; so that the public can secure all the kilowatt-hours of electric energy when and where it needs them. Finally, appreciation is paramount if the industry is to be able to se-

The industry is not in a position to stop and permit public understanding to catch up with it, so the task of widening and broadening public understanding becomes, if anything, the first of the industry's immediate problems.

This is no criticism of the general job that has been done, though recognizing its mistakes, which even critics must agree have been unimportant.

But a bigger and better job must be done in the future.

The electric light and power company does not ask sympathy.

It is entitled, in the public interest, to a fair opportunity to secure public understanding.

cure the lifeblood necessary for its future development; enough money invested in the business so as to make electric service possible in almost limitless quantities over wider and wider areas. It is absolutely vital that the public understands the nature of the utility business and appreciates its needs in order that the utilities' service can continue to measure up to the public's requirements.

Industry Recognizes Its Problems

The industry recognizes far more than the public its part of this job—perhaps the biggest job yet undertaken in its history. It is a job the proportions of which loom up as impressively as those of wartime financing. Its difficulties appear quite as large as the difficulties confronting the industry when it had to find a way for providing electric service to small towns equal in every respect to that of metropolitan areas. Indeed, finding that way, as it did, through public utility investment—or "holding"—companies, seems to have created the principal points of attack upon the industry for those who assail that which is successful, and thereby refute the axiom that "honesty is the best policy," on the theory that where there is success there must be questionable methods and unfair dealings.

Based on the diversity of the properties brought under their direction, these public utility investment companies establish a sound financial structure attractive to the investor. With the necessary capital thus made available they proceeded to unify small systems and replace inefficient local plants with economical large plants, adequate in capacity to serve a number of towns and a wide surrounding area. They broadened the service areas of these plants, embracing enough different users to cause more constant and economic use of the facilities. By strengthening the investment they lowered capital charges, which, together with reductions in operating costs, resulted in lower rates for service. By standing ready with ample power, they released small town industries from the principal restriction to their expansion, and they went out into the surrounding country with power for the development of natural resources and are now extending power to the farms.

Investment Companies Take the Lead

Thus these public utility investment companies blazed the way for the electrification of a new industrial frontier; they made inexpensive power available almost everywhere; they made it possible for the small town to share impressively in American industrial achievement; they are now helping farming to a power level with other industry. Then, one might almost say, stopping for breath in the midst of this accomplishment, the industry discovered it had passed the danger line of Owen D. Young's earlier prophecy: "It was fast outrunning public understanding."

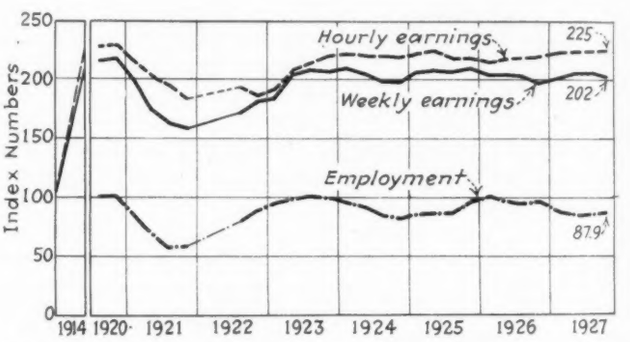
Public understanding is necessary so that each company will have the support of the public in its endeavors to give to the country the best service possible at the most reasonable rate consistent with good business judgment. This country has achieved an eminence in the industrial and commercial world greater than that of any other nation under a policy of free scope for private initiative, ownership and operation. Those nations that have not followed that policy are rapidly embracing it. It would be well if the nation, before changing that policy, would again ponder the words of the immortal Lincoln: "In all that the people can individually do as well for themselves, government ought not to interfere."

Trend of Remuneration

National Industrial Conference Board publishes conclusions regarding general wages and those in electrical manufacturing industry

THE importance of wages in general industry has led the National Industrial Conference Board to make extensive investigations in this field, the results of which have just been made public in printed form under the caption "Wages in the United States, 1914-1927." Through the co-operation of a large number of manufacturing establishments, building trades and many companies representing various branches of these manufacturing industries, data on wages, employment and hours are collected and published by the board each month. The present volume is a summation of these data since 1914.

In general there are four phases to the wage question: Wages in their relation to business conditions, wages



Index numbers of average hourly and weekly earnings and employment, all wage earners, electrical apparatus manufacturing

For earnings July, 1914 = 100; for employment June, 1920 = 100.

and prices, wages and the cost of living, and wages and the amount of employment.

The statistical evidence presented in this study makes it clear that during the year 1927 there was a remarkable stability in the compensation paid labor in all fields. Did this stability in wage payment imply a like stability in general business conditions? The board finds that, according to the more conspicuous business indicators, the change in the levels of business activity between 1926 and 1927 is nowhere conspicuous. The year 1927 exceeded 1926 in the production of raw materials, in mail order sales, in electrical energy consumption by manufacturing plants, and in bank debits, while the value of building contracts was about the same for the two years. On the other hand, the year 1927 fell below 1926 in prices, wholesale trade, unfilled orders and in factory employment. The detail figures show that no general change in business conditions took place during the year which would make the stability of wages a matter of surprise. During these two years there was an undoubtedly close relation between wages and business conditions.

The board points out that there is, however, a contrast in the mobility of prices and of wages. Just as prices are most sensitive to business changes and reflect every ripple upon the surface, so wages are among the least mobile of the major economic factors and are among the last to be affected by business changes. Only when such changes are profound do they cause perceptible variations in the remuneration of labor. A general and continued

Composite and Classified Payroll Data—Electrical Apparatus Manufacturing

	All Wage Earners						Male—Unskilled				Male—Skilled and Semi-skilled				Women			
	No. Wage Earners Index Nos.	Av. Week per Wage Earner	Av. Hourly Earnings	Av. Weekly Earnings	Index Nos. Earnings Hourly	Index Nos. Earnings Weekly	Av. Hourly Earnings	Av. Weekly Earnings	Index Nos. Earnings Hourly	Index Nos. Earnings Weekly	Av. Hourly Earnings	Av. Weekly Earnings	Index Nos. Earnings Hourly	Index Nos. Earnings Weekly	Av. Hourly Earnings	Av. Weekly Earnings	Index Nos. Earnings Hourly	Index Nos. Earnings Weekly
1914																		
July	.....	49.8	$0.272	$13.52	100	100	$0.220	$11.47	100	100	$0.300	$14.78	100	100	$0.165	$8.32	100	100
1920																		
Third Quarter	101.6	47.1	0.621	29.21	228	216	0.556	27.20	253	237	0.691	32.87	230	222	0.397	17.42	241	209
Fourth Quarter	101.9	47.3	0.623	29.47	229	218	0.560	27.26	255	238	0.689	32.86	230	222	0.403	18.04	244	217
1921																		
Third Quarter	57.6	41.3	0.533	22.00	196	163	0.401	17.60	182	153	0.588	24.27	196	164	0.347	13.53	210	163
Fourth Quarter	58.6	42.6	0.501	21.35	184	158	0.379	16.85	172	147	0.554	23.51	185	159	0.331	13.98	201	168
1922																		
Third Quarter	78.7	44.2	0.525	23.16	193	171	0.364	17.37	165	151	0.551	26.30	184	178	0.329	13.89	199	167
Fourth Quarter	88.5	48.0	0.509	24.43	187	181	0.378	18.50	172	161	0.566	27.68	189	187	0.337	14.65	204	176
1923																		
Third Quarter	100.0	48.0	0.584	28.07	215	208	0.443	21.99	201	192	0.647	31.67	216	214	0.374	15.93	227	191
Fourth Quarter	99.1	46.6	0.600	27.99	221	207	0.447	21.19	203	185	0.665	31.39	222	212	0.392	16.83	238	202
1924																		
First Quarter	95.5	46.7	0.605	28.23	222	209	0.450	21.36	205	186	0.669	31.56	223	214	0.395	17.21	239	207
Second Quarter	92.3	46.1	0.602	27.75	221	205	0.447	21.39	203	186	0.667	30.93	222	209	0.399	17.37	242	209
Third Quarter	85.2	44.9	0.601	26.95	221	199	0.444	20.83	202	182	0.665	30.00	222	203	0.401	16.99	243	204
Fourth Quarter	82.7	44.7	0.599	26.75	220	198	0.444	20.83	202	182	0.665	29.80	222	202	0.411	17.53	249	211
1925																		
First Quarter	85.1	45.9	0.606	27.86	223	206	0.459	22.04	209	192	0.672	31.08	224	210	0.420	18.22	255	219
Second Quarter	86.3	46.0	0.611	28.10	225	208	0.461	21.98	210	192	0.678	31.54	226	213	0.403	17.14	244	206
Third Quarter	86.4	46.8	0.597	27.95	219	207	0.458	21.99	208	192	0.666	31.52	222	213	0.385	16.91	233	203
Fourth Quarter	95.4	47.3	0.596	28.22	219	209	0.456	21.84	207	190	0.668	32.07	223	217	0.396	17.74	240	213
1926																		
First Quarter	100.1	44.1	0.584	27.55	215	204	0.470	23.06	214	201	0.657	31.71	219	215	0.421	18.06	255	217
Second Quarter	96.6	46.8	0.590	27.62	217	204	0.473	22.81	215	199	0.664	31.82	221	215	0.407	17.19	247	207
Third Quarter	95.2	46.0	0.594	27.31	218	202	0.477	22.39	217	195	0.662	31.72	221	215	0.424	16.41	257	197
Fourth Quarter	96.5	45.0	0.595	26.78	219	198	0.477	22.47	217	196	0.662	31.02	221	210	0.430	16.74	261	201
1927																		
First Quarter	89.0	44.8	0.608	27.24	224	201	0.478	22.57	217	197	0.672	31.49	224	213	0.431	16.14	261	194
Second Quarter	85.8	45.5	0.610	27.75	224	205	0.481	22.40	219	195	0.677	31.86	226	216	0.429	16.14	260	194
Third Quarter	86.2	45.5	0.610	27.77	224	205	0.485	22.44	220	196	0.678	32.17	226	218	0.425	16.13	258	194
Fourth Quarter	87.9	44.5	0.613	27.27	225	202	0.490	22.70	223	198	0.680	31.83	227	215	0.425	16.36	258	197

rise in prices, however, is, as a rule, followed at some distant time by a rise in wages. Conversely, a long-continued fall in prices may result in a decrease in wages. The third relationship considered in the report is that between wages and the cost of living. Cost of living is determined very largely by the retail price of commodities; hence, since men work not for the money they expect to receive, but for the commodities they expect to purchase with that money, the varying price of commodities, shelter and essential conveniences—that is, the cost of living—enters very materially into the question of wages.

The board is of the opinion, however, that an even greater movement in judging the wage situation is the amount of employment. Whether wage rates change or not, the position of the wage-earning group improves as employment increases and deteriorates as unemployment becomes more and more frequent.

Wages in Electrical Manufacturing Industry

In its tabulation and charts on the past trends and wages in the electrical apparatus manufacturing industry the conference board reflects these basic influences on wages and wage trends. The average hourly earnings of all wage earners in this industry were more than doubled during the war period, advancing from 27.2 cents in 1914 to 62.1 cents during the fall months of 1920, an increase of 128 per cent. During the same period the cost of living increased by between 105 and 93 per cent and the purchasing power of the dollar had been halved. It would appear, therefore, that the wage earners in the electrical manufacturing industry were in a materially better position at the end of the period than before the war in that their incomes had been increased to a greater extent than had the various items entering into the cost of living.

Then came the business depression of 1921, with a continuous drop in wages lasting until the close of 1922. With the evolution of the present period of continued high industrial and business operations, starting with the opening of 1923, the wages of the employees in the electrical manufacturing industry have slowly risen until in June, 1928, the average hourly earnings were 61.6 cents, an increase of about 126 per cent above 1914. During the same fourteen-year period the items entering into the cost of living had increased that index by only about 61 per cent. It would appear also that while the earnings of employees in the electrical manufacturing industry today are approximately on a level with those of 1920, the cost of living has decreased by about 21 per cent since that date and that since the opening of the year 1923 the wages have increased by about 21 per cent, while during the same period the cost of living has increased by only about 1.7 per cent. From almost any angle the wage earners in the electrical manufacturing plants are financially in a better position today than at any time in the history of the industry.

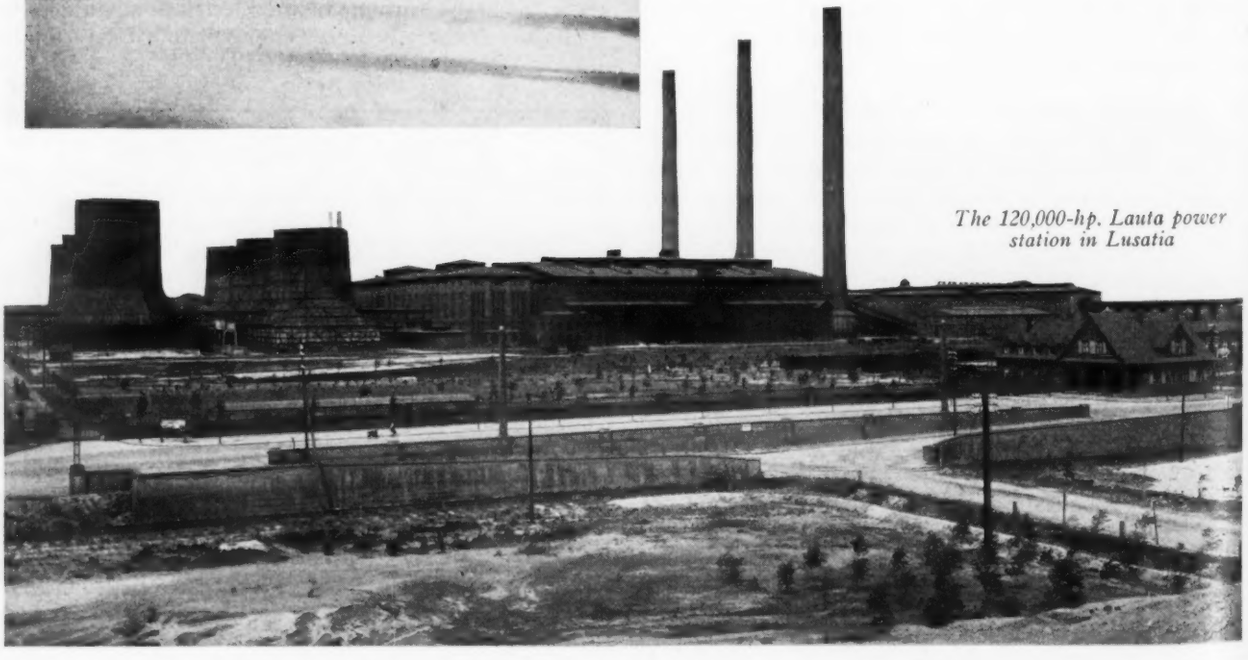
Cost of Installing Three Regulators—1926

Three 200-amp. I.R.S. regulators	$2,210.25
Three line drop compensators	84.00
40 ft. bar iron, 1 in. x ¼ in.	1.72
43 ft. bar iron, 1½ in. x ¼ in.	1.86
Miscellaneous hardware	5.04
Express	2.04
169 ft. flameproof cable, 250,000 circ.mil, 5 kv	49.51
42 ft. control cable, 19/22 4-conductor	3.78
25 ft. control cable, 19/22 5-conductor	4.00
Thirty porcelain cable cleats	17.70
106.5 gal. transil oil, No. 10	24.50
Miscellaneous material	40.24
Transportation	18.89
Labor	360.97
Liability insurance	1.38
Engineering services	59.43
Expenses	37.89
Total	$2,923.20

German Steam S

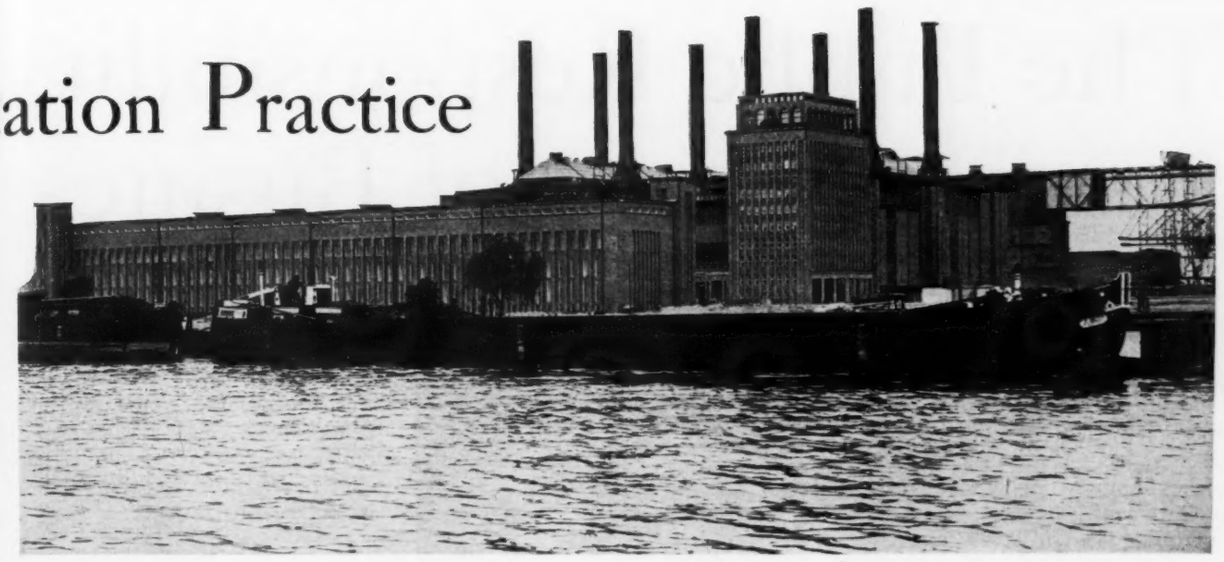
Lignite coal mine with Golpa station in the background

Boiler house in the Golpa station, where lignite is burned



The 120,000-hp. Lauta power station in Lusatia

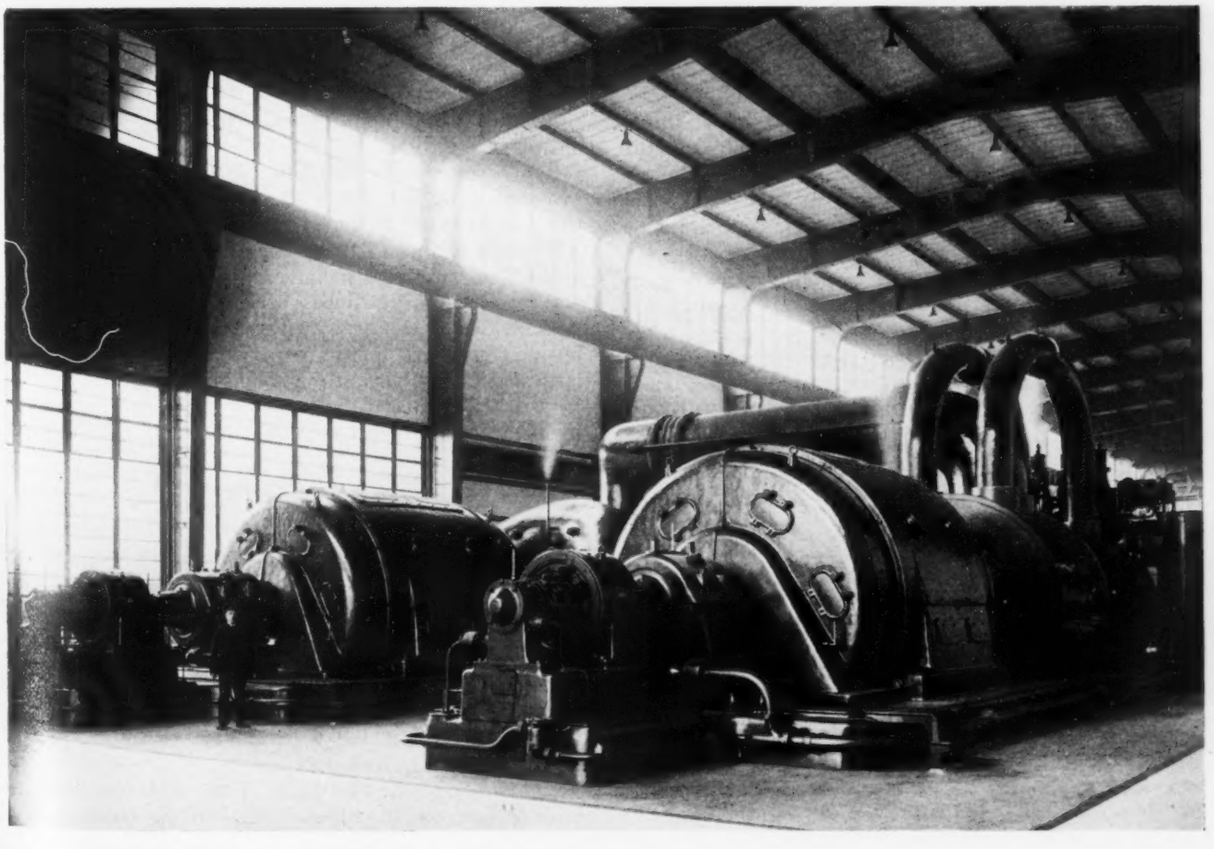
Steam Station Practice



The 368,000-hp. Klingenberg power station in Berlin

GERMANY has recently built several new steam stations. These plants embody new practices in many ways and are of interest to American station engineers. Cooling towers, lignite fuel and other features are shown in the accompanying illustrations.

A 110,000-hp. turbo-generator unit in the Klingenberg station



The Public Responsibility of Business

By WILLIAM BUTTERWORTH*
President United States Chamber of Commerce

WITH the emergence of business from the privacy of yesterday has come the conception of business as the servant of its public. It is most significant and noteworthy that with this conception business has taken on a new dignity —the dignity of higher standards of practice and conduct. To be sure, perfection has not been attained, but let him who doubts that marked progress has been made recall those unfortunate maxims more or less in vogue in an earlier day: "Let the buyer beware" and "The public be damned." Their error has long since been discovered, and the business man who still holds to these mistaken principles is the exception and not the rule.

William Butterworth

Yet even in those days before business had really awakened to a realization of its proper relation and responsibility to the community at large, its contributions to progress were recognized. It came to be understood, vaguely perhaps, that the world really became civilized as its business methods and technique improved, and as men learned to run things on plain business principles.

Awakening at length to the value of its public service and to the dignity of its place in the scheme of things, business began to assert that to serve a people's creature needs is quite as worth writing about as killing them in battle; that it is quite as romantic to furnish a people with the utensils of useful employment as to squander heritage in warfare; that it is quite as noteworthy an achievement to house a people in comfort in city and town and upon the farm as to lay waste a country with fire and sword.

Out of this realization came the requirement for a literature of business—a literature to interpret business to itself and to its public; to guide it into useful ways, to assert its dignity and to aid it in the fullest discharge of its duties and responsibilities.

Out of this need came the business press.

Yet another phase of the acceptance by business of its status as a servant of its public is its increasing practice of teamwork. Once business became convinced that it did not exist selfishly unto itself alone it began to understand that it needed the broader vision of organization and the courage of collective action to enable it to measure up to its requirements and responsibilities. Our chambers of commerce, local and state, and our national chamber; our trade associations, state and national, are the logical expression of this conviction. This teamwork is conceived primarily as a means to enable business more fully to measure up to its responsibility to its public.

Business fails in its greatest public responsibility if it fails itself to outlaw the trickster and his trickery; not waiting for the public, in its outraged confidence, to "call the cops."

Enlightened business, eager to fulfill its destiny in the world, asks freedom of initiative. Properly so. But even paramount to individual right is the public right, and the individual who forgets that larger right must bring upon himself and his enterprises and indeed more or less upon the entire business community outbursts of public wrath in terms of legislative and governmental regulation that may hamper and hamstring a legislative liberty of business initiative. Lawless, destructive initiative must be curbed. It must be curbed in the public interest and it must be curbed in the interest of lawful business. Organized business must lend and is lending a willing hand to this curbing through its own efforts at self-restraint and self-regulation. This aspiration is most worthy, and it is to the credit of the business press that it is bringing its influence more and more into aid of such efforts.

Moreover, in the solution of many of our business problems involving the public responsibilities of business the sympathetic attitude of government is necessary. This does not mean that business is, or should become, a petitioner for paternalistic legislation. But it is right and proper that business seek support for legislative policies that open the way for the collective wisdom of business to work out its own welfare, mindful that its largest good is always the public good. As the exponent for such aspirations the business press has before it an opportunity for most distinguished and most effective service.

FORUM AND PRESS NEEDED

Thus the success of business in measuring up to its public responsibilities depends in no small measure upon the courage of its organizations and the vision of its press. The organization is the business forum; the business senate. Here business canvasses and clarifies its opinion and arrives at its decisions. The business press, if it fully measures up to its opportunity, is the "guide, philosopher and friend," valued in counsel, because it is as free to caution and to admonish as to approve and acclaim.

Let me elaborate that idea. I am a thorough believer both in business organization and in the business press.

**Abstract of address presented before Associated Business Publishers, Inc., New York, Nov. 16, 1928.*

Both are potent allies of business and industry. But let me say that the business press should not content itself merely with reporting business deliberations and business decisions. It should take part in them. And in saying this I have no thought to detract from the value of the reporting function. That I know to be most valuable—that interchange of business experience. It enables me as a manufacturer in Illinois to profit by the successful methods of others, and it enables me to avoid errors that have been discovered elsewhere. That, I repeat, is a service of the highest order. But as a business man, as a manufacturer, as a member of trade and business organizations, I need, too, the candid advice of the business press. The business paper with its trained observers scanning the business horizon naturally has a wider view and an even better perspective upon the inter-relation of business events and movements than either the trade association or the individual business man. The value of this detached viewpoint and of the frank and friendly counsel of the business press cannot be too highly estimated. The business press has universal contact with business; it has the opportunity to mirror business to itself, and fearlessly to advocate sound policies and win for them the approval of both business and the public.

Moreover, never was the opportunity greater than now for the business press to make itself indispensable to business and industry. Never had it a like opportunity to stimulate leadership. For our business world is a rapidly changing world. In all its phases its processes are undergoing almost revolutionary readjustments. These require a new strategy, new tactics, new methods and, above all, unflagging fortitude and courage.

Business Press Needed

The business press, therefore, needs, it seems to me, to make of itself more than an accurate chronicler of events. The business publication that fully grasps its present opportunity will readjust itself to these changing conditions and interpret them. It will look beyond the things of today and point the way to sane procedure for tomorrow. It will serve as a clearing house of ideas. It will evolve new ideas.

It will not lull its readers into a false security by continuous sounding of the note that all's well in the best possible of business worlds if and when it knows that far-reaching change is just around the corner. It will, rather, keep its readers alert and stimulate their individual thinking by candid discussion of facts and new ideas and changes it sees in the offing. It may, now and then, have an unpalatable truth to tell and the telling may make some of its readers angry. They may even write in and "stop their subscriptions." But even an angry subscriber can't turn aside the current of events, nor make black white, but if the watchman in the tower be asleep, then there is indeed none to warn of approaching danger.

Above all else it will seek out those flaws and deteriorations within business and industry, those bad practices which tend to undermine and destroy the good name of business, and will vigorously counsel measures—measures to be undertaken by business itself—to scotch these evils. It will team up effectively with organized business—not to take the place of organization—but to give to business organization the immense weight of its influence in the great task of fulfilling the obligations which the public has every right to expect business fully to assume and as fully to discharge.

Precautions During Installation
that Avoid Breaker Trouble

By H. G. MacDonald
Circuit Breaker Engineering Department, Westinghouse Electric & Manufacturing Company

THE author emphasizes some steps in receiving, erecting and adjusting oil circuit breakers that are frequently overlooked or slighted to the user's detriment. Since it is most important that circuit breakers function in emergencies involving short circuits and prevent serious damage to other important parts of the system, it is essential that the apparatus be properly installed in the first place, and subsequently subjected to periodic inspection that will keep the operator aware of the condition of the breaker at all times and permit the maintenance required to keep it operating at highest efficiency.

Protect from Weather and Dirt

The care given apparatus should begin with its receipt on the premises at the plant. The consignor has taken certain precautions in the packing and shipping of the breakers to protect the parts against damage during shipment. But the parts should not be left exposed in shipping crates indefinitely. Certain parts are composed of non-vitreous insulating material which is susceptible to moisture. Metal parts are often of corrosive material and while rust-proofed sufficiently for service conditions will not remain rustless under continued exposure to atmosphere and moisture. The apparatus should therefore be suitably housed if it is not possible to install it immediately under practically operative conditions, when it will, of course, be self-protecting. If there is concrete construction work in progress a small amount of trouble and time expended to protect the apparatus from the dust and grit incident to this work will save hours of time for dismantling and cleaning later if this precaution is overlooked. Circuit breaker shafts and bearings do not work any better than any others if filled with dirt and grit.

Adequate Anchoring Essential

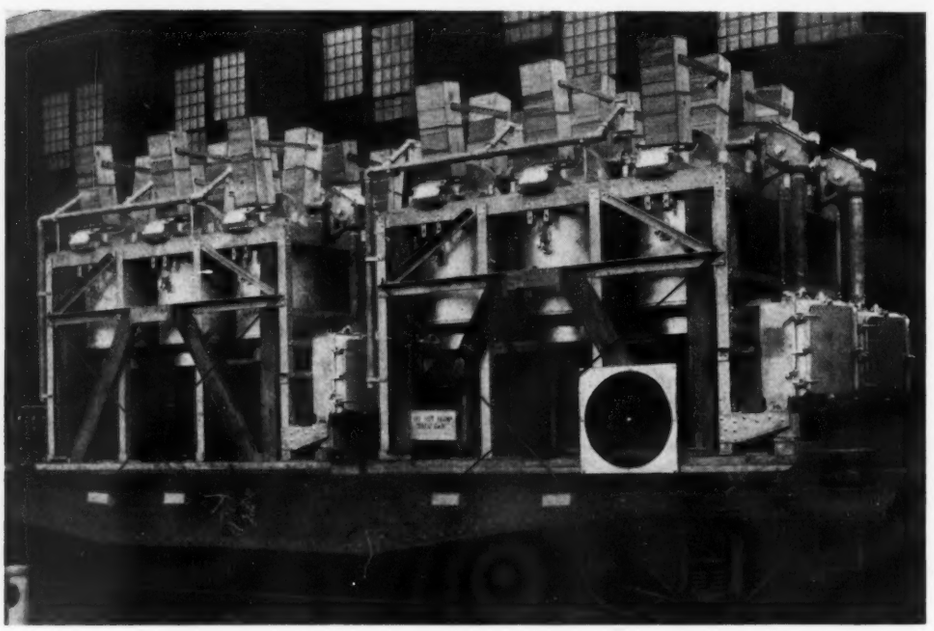
The performance of the breaker under short-circuit stress will depend to a large degree upon the adequacy and permanence of the foundation which has been provided for it. It must be solid, sufficiently reinforced to prevent an uneven setting that would destroy the alignment and must have anchorages imbedded in it for securing the breaker. These anchorages should conform with the suggestions of the manufacturer, who is familiar with the heavy reaction which the holding-down means must impose when the breaker operates under load. Inadequately anchored breakers have frequently shifted sufficiently to interfere seriously with successful functioning.

The skids and crating with which the breaker is shipped will probably be found convenient in moving it from the car to its permanent location and will protect it during this operation. Bracing is usually employed which will prevent racking or springing of the parts during transit. Time and trouble and possible damage to apparatus will be saved while uncrating and unpacking if a little time is spent in planning and preparation for the reception and placing of the various pieces, having in mind the final location and order of assembly of the units.

There are always identification marks on the parts entering into an assembly. By keeping groups under the same identification marks together the complete

breaker can be more readily assembled and will function more smoothly because the correspondingly identified parts fitted and operated together. This does not mean that parts are not interchangeable, but simply that the parts identified by the same number have been "worked in" together and will work smoothly if again put together. If the erection foreman is not entirely familiar with the apparatus to be unpacked and set up, his time will be well spent if he goes over the instructions accompanying the breaker and takes advantage of suggestions therein. Erection men sometimes consider that it is a reflection on their ability to be asked to consult an instruction book. The manufacturer does not necessarily doubt their ability finally to attain the results desired, but can often suggest short cuts which will save time and effort and frequently prevent an impression of inadequacy or complication.

It seems unnecessary to suggest that, before beginning to unpack, a check should be made to see if all packages



Many times parts of the bracing and crating can well be left in place until the breaker is in its permanent position

listed in the shipping report are at hand. It should be equally superfluous to urge care in unpacking, not to wreck boxes and crates with sledge and bar and run the risk of also wrecking some fragile portion of the apparatus. However, cases are known of disregard of such precautions with disastrous results. Lost parts are many times the result of assuming that the packing material in a box conceals no more than the large object first revealed.

There is usually a sequence of operations, which if properly followed greatly simplifies the set-up and adjustments. Detail assemblies are often grouped in such a manner that they can be handled as units. Adjustments if made and checked in the proper order can be secured in much less time than if attempted in some other order. Before condemning the piece of apparatus because it apparently has failed to assemble and function properly, give the supplier the benefit of the doubt and assume that the statement that the device has been assembled, tested and operated successfully before it was sent out is correct. Check the instructions again carefully and the chances are good that the solution of the difficulty will be found.

Control voltages are supposed to be checked at the coil terminals, not at the control board. This may account for an apparent failure to operate at a required minimum voltage. Coil resistance varies with change in temperature, and a coil soon heats up if operated repeatedly. In checking breaker operation, resistance readings must be reduced to 25 deg. C., the standard base temperature. Occasionally an unwarranted drop may occur in the control circuit, and the breaker coil may not be receiving the voltage to which it is entitled. Operating speeds are given on the basis of the normal voltage at the coil at 25 deg. C.

Proper functioning of the complete assembly and smooth operation over the range of control voltage will be obtained if each part of each unit is individually tried out for friction, interference, too much play, etc. Any factor tending to prevent proper co-ordination of all parts when finally connected together can best be eliminated as the assembly progresses. If the erector is sure that each pole unit has the proper setting of levers and stops and has adequate contact pressure when its levers are in position against these stops, then if, when he makes final connection between the units, one pole fails to come into proper contact position, he can be reasonably sure the trouble is in the connecting means. Rather than disturb the levers and stops in the unit, the erector will then make the required readjustment to the connecting member, because he knew that he erected the unit correctly when he checked its setting. A warning that is worth heeding is to "check these settings against the instructions—don't guess at them." Unless such a systematic method is followed the installer will find himself hopelessly tangled and will eventually have to start all over with the pole-unit adjustments.

One of the operations, which seems on the face of it to be about the simplest of the entire installation, may prove to be the most troublesome, viz., the safe introduction of oil into the circuit breaker tanks. If this is done during cold or wet weather almost endless filtering and testing may be necessary unless certain comparatively simple precautions are observed. Very complete instructions for handling this step accompany the oil shipments and they are worthy of close attention. However, all of this care may go for naught unless the completed assembly is made tight against admission of rain, snow or other moisture. There are certain outlets from the pole units which must be made tight. Connection parts between units for connecting rods and for transformer leads and the vent piping must all have tight joints or else moisture will penetrate the structure, with disastrous results. Many of these joints must be made by the erector.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

The Maentwrog Hydro - Electric Scheme.—Description of the design and construction details of recent developments in Wales, with particular reference to the new water-power plant in the Afon Prysor Valley. The Maentwrog hydro station is equipped with three 7,500-kva. turbo-generators and operates under a maximum static head of 630 ft. Horizontal impulse water turbines are used, each being provided with two runners in a single casing and keyed to the same shaft. Four nozzles per turbine are provided, so arranged that two jets impinge on the buckets of each runner. The direct-connected alternators are of the standard low-speed, salient-pole type, operating at 6,600 volts. Iron-clad switchgear is utilized and the power is transmitted at 66 kv. to a neighboring point.—*Electrical Review (England)*, Oct. 26, 1928.

Pulverized Fuel Plant for the Use of Colliery Waste.—A generating plant utilizing pulverized fuel but operating with colliery waste as a supply is described in this article. The fine coal formerly removed at the colliery by washing is now taken out in the dry state by passing the coal down a long inclined screen to the washery, where the dust and small stuff separates by gravity and is collected in a chute below the screen. The various mechanical features of the plant and the methods of preparing the fuel have been fully described. The possibility of utilizing material which has been designated as coal refuse and has hitherto been considered unsalable, at the colliery described, has been pointed out.—*Engineering (England)*, Oct. 26, 1928.

Generation, Control, Switching and Protection

Remote-Control System Without Pilot Wire for Alternating-Current Network. —M. Durepaire. — Various methods have been advocated in the past for the transmission of impulses over distribution wires to remotely close or open certain circuits, such as street lamps, or to change meters from one to another tariff. All of these methods required either a separate pilot wire or a high-frequency generator. The present article suggests a novel method, suitable for alternating-current systems with neutral wire, in which a periodically reversing direct current is impressed between the neutral wire and ground. An electrically driven pendulum produces rectangular direct-current impulses, which are sent out and picked up by a simple polarized relay. To introduce selectivity, a second relay is in series with the pick-up, responding to heating. This second relay may be adjusted to the cumulative heat effect produced by any chosen number of individual direct-current impulses.—*Revue Générale de l'Electricité*, Oct. 6, 1928.

Hydro-Station Peuffeyre.—L. Favrat and V. Abrezol.—A recently completed Swiss water-power station is described in this article, which utilizes 60,000 gal. of water per minute, under a head of 1,300 ft. One penstock, $\frac{5}{16}$ of a mile long and 47 in. in diameter, constructed of welded steel pipes, carries the water to the power house, in which are installed two 5,000- and one 3,000-hp. Pelton type wheels, each for a speed of 750 r.p.m., coupled directly to two 4,400- and one 2,600-kva., three-phase, 50-cycle, 6,000-volt generators. An unusual feature of this station is a 2,000-kva. induction voltage regulator, which is interposed between the double busbar system. Controlled by an automatic power factor regulator, this arrangement permits the independent supply of two main centers of power consumption, irrespective of voltage variations within the limits of 5,200 and 6,000. For a nearby supply two feeders, directly from the busbars, furnish 5.6 kv., while two radiator type 5,000-kva. transformers feed a 116-kv. transmission line. Three single-phase, 120-kv. circuit breakers, of a rupturing capacity of 750,000 kva., control this high-voltage line. The entire equipment is installed indoors.—*Bulletin de l'Association Suisse des Electriciens*, Oct. 22, 1928.

Units, Measurements and Instruments

One-Piece-Porcelain Current Transformer.—W. Reiche.—The well-known advantages of the bar type current transformer, particularly its absolute safety against damage due to short-circuit forces, made it desirable to devise a similar construction for smaller currents, where several primary turns are required. This seems to have been accomplished with the so-called one-piece porcelain type. Seven years of practical experience indicate a fully satisfactory performance even under the most adverse conditions. The main body represents a double conical porcelain bushing with small petticoats for indoor use, and large ones for outdoor service, with a square cylinder, piercing the bushing horizontally through its middle plane. This gives a somewhat complex piece of porcelain. The primary lead enters on top, makes a few turns around the outside of the internal cylinders and emerges at the bottom. The inside of the porcelain is then filled out with a mixture of sand and graphite. The former prevents dislocation of the turns, the latter distributes the static field. Iron core and secondary winding penetrate through the inner part of the horizontal porcelain cylinder. A variation of porcelains are available for types of 30 to 120 amp. and test voltages of 42 to 119 kv. In addition to being short-circuitproof, the absence of oil or compound, low stray leakage and ample heat capacity are said to constitute important features of this new type.—*Elektrotechnik und Maschinenbau*, Oct. 21, 1928.

Effect of Clearance and Displacement of Attracted Disk and Also of a Certain Arrangement of Conducting Hoops Upon the Constant of an Electrometer. — Chester Snow. — The author has derived formulas for the force upon the attracted disk of an absolute electrometer. These take account of the clearance between the attracted disk and its guard plane, their relative displacement and the separation of the plates. The effect of using a set of conducting hoops to compensate for the finiteness of the movable plate has also been computed.—*Bureau of Standards Journal of Research*, October, 1928.

Transmission, Substations and Distribution

Distance Relay. — J. Stoecklin. — Selective network protection for long and interconnected transmission systems aims at the localizing of faults with a minimum of disturbance to the sound parts of the system. This requires the response of relays and subsequent opening of breakers strictly confined to the source of fault. A new design of such a selective relay is described, which is claimed to fulfill the above requirements with a hitherto unattained accuracy and precision. It consists of a mechanical combination of three instruments: An impedance relay of the electromagnetic type, a spring-actuated time element, and a cross-coil ohmmeter, controlling automatically the tripping time. A mechanical cam connection is provided between the relay and the ohmmeter. Among the features of this new instrument may be mentioned instantaneous resetting, selective time up to five seconds, 63 watts energy consumption, high sensitiveness to current reversal, insensitiveness to current variations of up to twenty times rated current. Practical experiences are quoted from a number of installations and test set-ups.—*Brown, Boveri Mitteilungen*, October, 1928.

Illumination

Street-Lighting Costs per Capita and per Kilowatt-Hour. — Street-lighting costs for 42 cities in the United States, with per capita equivalents, were published in the Electrical World for July 7, 1928. In the report of the Hydro-Electric Power Commission of Ontario, issued in July, there is a table of Canadian cities served, also reduced

to a unit basis. The July number of *American Municipalities* gives data on fourteen cities in Iowa. The most comprehensive recent compilation is contained in a report by F. W. Ballard, which gives data on street lighting in 270 municipalities. The article summarizes the scope of these various compilations.—*The American City*, October, 1928.

Motors and Control

Effect of Commutating Poles Upon Brush Currents.—C. SCHENFER.—On direct-current generators with several brushes on each brush-holder it is commonly assumed that the total current per brush bolt divides equally among the brushes on the bolt. Experimental investigation by the author disclosed the surprising and hitherto unknown fact that this is not necessarily true. Irregular and even reverse current was found. For his investigation the writer insulated the individual brushes on one brush bolt and carried each brush connection to an ammeter. Main field and commutating poles were separately excited from storage batteries, with a regulating rheostat in the latter circuit, to change the flux in the auxiliary poles. Under or over-excitation had marked influence upon the current distribution among the brushes. A theoretical attempt is made to explain this phenomenon. It seems that for a loop winding on the armature equal load on the brushes is assured under all conditions. With an armature of the wave type winding, a similar current equalization among the brushes can be obtained only with correct excitation on the commutating poles; that is, only in the case when the reactance voltage is perfectly compensated.—*Elektrotechnik und Maschinenbau*, Oct. 14, 1928.

Heat Applications and Material Handling

An Improved Spark Gap Generator for High-Frequency Furnaces.—WALTER ROSENHAIN and FRANK ADCOCK.—Many high-frequency furnaces of moderate capacity are energized by oscillations generated by means of some form of spark gap, according to the authors. A recently perfected device in which the spark gap consists essentially of two water-cooled copper electrodes supported so that their lower ends are just above the surface of a mercury pool is described in this article. The outer vessel containing the mercury is also water cooled, and the whole apparatus is made approximately airtight by means of a large spring lid and washer. Both electrodes are supported laterally and insulated from the outer metal pot or containing vessel by tubes of fused silica. The inclosed chamber is filled with hydrogen before sparking is commenced, care being taken to eject all air to avoid the risk of explosion. A continuous supply of hydrogen is also necessary during the operation of the spark gap. This equipment is said to have been in successful operation for several months and to have proved more reliable than the previously utilized devices. Advantages include higher powers and, consequently, larger charges of material in the furnace than have previously been found desirable. The writers have modified a spark gap of the ordinary pattern so as to eliminate the troubles inherent in spark gaps fitted in removable electrodes. Fixed electrodes are used, and the mercury level is adjusted by placing the spark gap chamber in communication with a special mercury displacement chamber instead of a removable reservoir. This mercury displacement vessel consists of a cast-iron vessel in which an iron armature is mounted eccentrically on a horizontal axis.—*Electrician (England)*, Oct. 12, 1928.

Electrophysics, Electrochemistry and Batteries

Recent Research of Current Interruption Under Oil.—J. KOPELIOWITSCH.—Starting with Steinmetz's original investigations on the rupture of current under oil, the author reviews in the preface of this extended treatise the work of later investigators. Based upon a great amount of partly contradicting test data, the characteristics of an a.c. or d.c. arc under oil are studied, as affected by voltage, speed of opening, number of breaks, contact material, shape of contacts, current, influence of static pressure, frequency, power factor and length of arc. Physical, mechanical, electrical and chemical phenomena within the switch tank are also carefully examined, the conclusion being reached that the oil-piston theory seems to be correct. High-speed motion pictures, recording up to 300 phases per second on an experimental switch in strong glass tank, rupturing as much as 12,000 kva., proved of great value in studying the formation of arcs and gases. With a clever arrangement of a mirror, front and side views were taken simultaneously. The principle of the explosion chamber type of breaker is then investigated, which tends to show that a multi-break is superior. This contention was further verified by extended field tests made in America and in Switzerland. Finally the electrodynamic forces are investigated, which occur in closing a breaker upon an existing short circuit.—*Bulletin de l'Association Suisse des Electriciens*, Sept. 1, 1928.

Traction

The Possible Application of High-Frequency Power to Electric Traction.—W. CRAMP.—It is pointed out by the author that there are three possible means of supplying power for electric traction purposes, namely, battery supply, overhead lines with direct condensers and induction. The latter possibility is the subject of the present discussion. It is shown, however, that transmission by induction involves the use of alternating current and that the alternating-current motor is not ideal for traction purposes. It is contended, however, that the elimination of all sliding contacts would certainly outweigh the advantages of the motors. Again, alternating-current transmission would lead to interference with neighboring telephones and telegraphs if ordinary frequencies were used, so that the choice of a suitable periodicity is a matter of importance. The historical development involved has been pointed out and the theoretical consideration developed in somewhat brief fashion. It is stated that the system which is proposed, although at present undeveloped and crude, can be made into an efficient commercial arrangement.—*Engineering (England)*, Oct. 26, 1928.

Arrangements of Feeders and Equipment for Electrified Railways.—R. B. MORTON.—An outline of the general requirements governing arrangements of distribution systems and substation equipment for electrified railways. Illustrative examples consisting of descriptions of recently completed electrifications of steam railroads have been included. Typical substation layouts and substation equipment factors are presented.—*Journal of the American Institute of Electrical Engineers*, November, 1928.

Telegraphy, Telephony, Radio and Signals

High-Voltage Dynamos for Anode Potential.—H. SCHULTHESS.—Instead of providing the high direct-current potential, necessary on the anodes of vacuum tubes, by primary or storage batteries, successful attempts have been made with high-voltage generators. Built similarly to the original Thury machines, a number of modern improvements have been introduced in this equipment giving such perfect commutation that voltages as high as 12,000 may now be obtained from one commutator. Greatest attention must be paid to slot insulation, calling for high-grade labor. It is not unusual to have a copper fill factor of only 3.5 per cent in the slots of these machines, the remainder representing the necessary slot and wire insulation. Micanite, as thick as 0.14 in., has to be used to insulate the individual commutator bars, between which may be a potential of up to 250 volts. It seems that with present experience such generators can safely be built for as much as 20 kv. per commutator in sizes of 20 kw. and up.—*Elektrotechnische Zeitschrift*, Oct. 18, 1928.

High-Speed Ocean Cable Telegraphy.—OLIVER E. BUCKLEY.—A review of the design, construction and operation of loaded telegraph cables with a brief history of the development of the permalloy loaded cable and discussion of its field of application. The invention of permalloy and its application to submarine cables have, according to the author, led to the installation of transoceanic cables of many times the traffic-carrying capacity of the former non-loaded cables. A brief history of the development is included.—*Reprint B-310 Bell Telephone Laboratories, Inc.*

News of the Industry

National Electrical Code and Grounding

Utilities Present Brief Against Present Rules—Inspectors Called on to Give Evidence—Acceptance Is Asked for Polarized Identified Circuit Wire

THE much-argued question of whether the polarized identified circuit wire should be admitted to the National Electrical Code as a suitable ground circuit for interior wiring was brought up at a public hearing of the electrical committee of the National Fire Protection Association in New York City on Nov. 15 and 16. Consideration was also given to whether frames of portable equipment in domestic installations should be grounded, and, if so, how and under what conditions. This hearing was conducted as the basis for determining necessary modifications of or additions to the code.

There was a large attendance, in which inspectors, utilities' and manufacturers' representatives and a few contractors were conspicuous. A. R. Small, Underwriters' Laboratories, presided as chairman of the electrical committee.

In presenting a seventeen-page brief stating the attitude of the utilities, J. D. Noyes, Detroit Edison Company, analyzed some commercial aspects of the situation, voiced an objection to any trend in the code which will handicap increased utilization of electricity, called attention to the high per capita domestic consumption in Sweden and Switzerland, pointed to the greater hazard from improper use of extension cords or their use in damaged condition, and alluded to the effect of cost of wiring on use of electricity. He particularly emphasized the code recognition already given to the polarized identified circuit wire and asked that it be admitted as another means of providing interior ground circuits under certain restrictions.

In opening the discussion on the advisability of the code admitting the polarized identified circuit wire as a grounding method, Mr. Small took the subject up in parts. For example, he asked for evidence on (1) the possibility of polarity reversal by the utility and within the customer's premises, and (2) the possibility of the ground circuit becoming open.

Considering the possibility of polarity reversals in utility operations, several inspectors reported. Mr. Briggs said that he had experienced only three to seven reversals in seven to eight years and these were quickly detected and remedied. Mr. Ward, Newark, reported three or four out of 50,000 jobs in three or four years, but they were immediately remedied. Mr. Daniels, Wisconsin, reported none in five years where the mistake was not promptly rectified. Furthermore, several of those present emphasized the fact that the metermen have an additional check. Recounting utility experience, Mr. Bonnett, Brooklyn, said that it is absolutely impossible for a lineman to make a ground wire alive without detecting it. Mr. Coles, Boston, and Mr. Good, Chicago, corroborated this statement, the latter saying that his company had had no trouble in many years. Mr. Wagner, Philadelphia, reported only one polarity reversal in half a million cases in three years. Mr. Elden, Boston, reported no trouble in fifteen years.

Commenting on the possibility of polarity reversals inside a customer's premises up to the outlets, inspectors reported as follows: Mr. Graham declared that the code does not require identification of wire larger than No. 6, so the possibilities of reversal are greater with the large sizes. Mr. Ward admitted that incompetent electricians might reverse the polarity. Speaking as a contractor, Mr. Coggeshall said there is always the chance of error inside buildings, but with identified wire reversal of polarity would be the result of carelessness. Speaking for utilities, Mr. Good emphasized that the use of a polarized identified circuit ground wire would make linemen, contractors and the public all more careful about reversals.

The possibility of the ground circuit becoming open was then discussed, but observations were confined chiefly to the polarized identified circuit. Mr. Small raised the possibility of the ground-wire test strap being left open and Mr. Coggeshall the question whether terminals would be kept tight. Mr. Wellman declared ground connections had been deliberately cut in New Orleans. Mr. Good pointed out that with the polarized identified ground circuit an open circuit would be directly indicated by the inoperability of equipment. The request for this method of grounding was based on a solid neutral with no fuse. He expressed a preference for no switch in the neutral or else a multi-blade switch which would break all circuits. To this Inspector Bendell agreed. Mr. Coles said that removable test straps have not been used for two years. Mr. Magalhaes, New York, contended that there is just as much chance of an auxiliary ground wire opening as of a polarized identified circuit doing so; besides, opening of the former would not be indicated and would therefore give a false indication of protection. Admitting that either can be opened, which will remain open the longer, he asked?

Summarizing the discussion, Chairman Small pointed out that considerable evidence had been presented on the reliability of the polarized identified circuit ground wire, but asked utilities to outline the conditions under which they consider it unsafe.

Several utility men, in answer to questions raised during the discussion, emphasized that acceptance is asked for the polarized identified ground circuit only under certain conditions, not as an exclusive means, but as an alternative method. For example, Mr. Maxwell of the N.E.L.A. admitted that where metal inclosures are used they are the natural agency for grounding. Mr. Bonnett pointed out that the identified polarized wire is desired only on alternating-current systems below 150 volts where every service has two separate grounds. Furthermore, it is recommended only up to the customer's outlet. Beyond that no recommendations have been formulated.

Inspector Wellman of New Orleans commended the request of utilities that due consideration be given to isolation and insulation as well as to grounding for protection.

Chairman Small pointed out that if the polarized identified circuit ground wire be accepted in the code, consideration would have to be given to whether the ground should be interconnected with or separated from other ground wires.

International Association of Inspectors Launched

The first meeting of the executive council of the International Association of Electrical Inspectors was held in the rooms of the National Board of Fire Underwriters, New York City, on Nov. 14. With the exception of representatives from the Northwest Electrical Inspectors' Association and the California association all representatives were present and took part in the proceedings.

Articles of association were considered and adopted, and in accordance with these articles the International association was duly organized by the election of the following officers: President, J. C. Forsyth; first vice-president, W. H. Boyd; second vice-president, R. H. Manahan; third vice-president, F. D. Weber; fourth vice-president, N. E. Cannady; secretary-treasurer, Victor H. Tousley. The association starts off with a membership of about two thousand. It is expected that its main office will be in Chicago.

It is the desire of the executive council to interest all inspectors and inspection organizations throughout the

United States and Canada in the development of the National Electrical Code from an inspection viewpoint and in the uniform application and enforcement of its provisions, as well as to co-operate with all other electrical bodies in promoting the common objects of the industry.

Hopkins Research Meeting Draws Many

Test for Faulty Impregnation—Ionic Bombardment Forms Water—High Pressure and Vacuum in Cables—Need to Simulate Operating Conditions

HIGH-VOLTAGE underground cables and their troubles were the subject of an important conference on Nov. 16 and 17 at Johns Hopkins University, Baltimore. It was organized by Dr. J. B. Whitehead, chairman of the committee on electrical insulation of the National Research Council. The important problems presented by impregnated paper received special attention. The conference was attended by 75 delegates, many representative engineers from all branches of the industry being present.

D. W. Roper, Commonwealth Edison Company, pointed out that the American Telephone & Telegraph Company devotes the time of 1½ per cent of its employees to research. On this basis power utilities would have to spend $300,000 every year on cable research alone. Since many power utilities are not financially affiliated, the best research results can be attained with a given expenditure of money only by co-ordinating effort, developing researchers and keeping accurate records.

Judging from the inability to weed out faulty cables with direct current, Mr. Roper recommended using a voltage more than two and four-tenths times the alternating-current test voltage.

C. F. Hirshfeld, Detroit Edison Company, related some investigations into the mechanism of cable breakdown. He declared that pressures as high as 85 lb. per square inch develop within cables on heating and vacuums as low as 15 in. to 16 in. Hg. (more likely 24 in. to 25 in. if measurements are accurate) on cooling. When oil is subjected to ionic bombardment, polymerization will occur and the hydrogen gas produced, coupled with paper deterioration, has been found to produce three times as much water as originally existed. This would account for increase in dielectric loss, but not entirely for deterioration.

Prof. Vladimir Karapetoff, Cornell University, reported attempts to determine the molecular character of compounds which will undergo the least deterioration. Ernest Linder, working under his direction, outlined details of test methods to ascertain the separate effects of temperature, vapor pressure, current and potential. Some evidence was found that loosely coupled hydrogen atoms are undesirable, but vapor pressure is also important.

W. F. Davidson, Brooklyn Edison Company, called attention to high-frequency oscillations beginning about the peak of each charging-current wave and with an amplitude that fluctuates as high as double the fundamental. While some components were found due to test apparatus, the high frequencies are apparently caused by gaseous breakdown in the cable.

G. B. Shanklin and G. M. J. Mackay, General Electric Company, gave a résumé of cable research, saying that oil-filled cable is more adaptable to scientific analysis and that temperature limits of solid cable should be reduced. Manufacturers can now produce cable with only 1.3 per cent of voids and straight-line ionization curves. Maintenance of impregnation in service is the major problem. Attention was called to the fact that ionization occurs chiefly at low temperatures and low loads. Swelling of cable sheaths is not extreme and is confined chiefly to risers. Careless handling in installation, excessive loading and high short-circuit temperatures must be avoided, the speakers warned. The manufacturer's problem is to keep voids as small as possible and make the gas pressure increase with corona to reduce damage.

Impregnation Problems

F. M. Farmer, Electrical Testing Laboratories, related some analyses based on inspection of 67,000,000 ft. of impregnated cable. Single-conductor cable shows the longer life. Of 536 samples of "failed" cable, only 26 per cent were due to inherent faults, and of these 86 per cent were due to insulation.

In the discussion of these papers Mr. Roper declared that observations in one case showed a sheath temperature rise of 25 deg. C. almost momentarily, owing to a short circuit, and probably double that temperature in the copper. Accelerated life tests give little indication of service experience. Something is needed to simulate the heating and cooling cycles in operation.

T. F. Peterson declared that the expansion of cable sheaths permits migration of oil and thus prevents dangerous pressures usually caused by obstructions. W. A. Del Mar called the attention of delegates to Detroit's heat-cycle voltage test of cables, but because they do not anticipate service results, tests must be developed co-operatively which will do so.

At another session Prof. V. Bush, Massachusetts Institute of Technology, showed by curves the presence of a characteristic between the disruptive and breakdown characteristics of insulation that may be due to both. It was detected by eliminating the concentration of dielectric stress around test electrodes. Prof. C. L. Dawes, Harvard University, observed that the power loss due to ionization is proportional to the voltage and that due to the dielectric is proportional to the square. However, no definite relation between power factor and extent of ionization has been found yet.

Prof. E. B. Paine, University of Illinois, described a very interesting investigation being conducted for the Utilities Research Commission to determine methods of locating faulty impregnation in cables and the extent of faulty impregnation regardless of location. By exciting the cable with 60-cycle power and balancing out the capacity and leakage currents in a modified Shearing bridge, high-frequency disturbances have been observed such as Mr. Davidson mentioned. These are passed through a 60-cycle filter and an amplifier and their magnitudes are compared. Professor Paine did not know whether these disturbances are of major importance, but they produce light and sound and possible chemical action. R. J. Wiseman said that though manufacturers have the elimination of voids well in hand, they still have the dielectric problem. He expressed the opinion that this is due to ionization within the dielectric.

After W. A. Del Mar and C. H. Sharp had praised the value of the meeting most highly, Prof. C. A. Adams urged solicitation of the co-operation of foremost physicists and chemists. The conference closed with a meeting of the committee on electrical insulation in which Professor Whitehead presented a survey of present fundamental research in dielectrics and insulation and the opportunities offered for further progress.

Philadelphia Has Successful Electrical Exposition

Thirty-six searchlights, with a total rating of 2,500,000,000 cp., on the roof of the Commercial Museum in Philadelphia this week have simulated the aurora borealis and advertised the electrical exposition being held there. One hundred and eighty-eight exhibits, covering both the light and power and the radio field and displayed amid an especially brilliant lighting scheme, have been visited by great crowds of citizens. A novel feature is an electrical pageant showing Napoleon's siege of Moscow while an orchestra renders Tschaikowsky's "Overture of 1812." Over the various booths is the "Canopy of Kings," with constantly changing colors.

The show, the first on a large scale to be held in Philadelphia for seventeen years, was fathered by the Electric Club of that city.

Princeton University Dedicates Engineering Building

More than two hundred engineers and scientists from many parts of the country gathered at Princeton, N. J., on Nov. 15 for the official dedication of the new half-million-dollar Engineering Building of Princeton University. This number included representatives from 38 technical and engineering universities, who formed an academic procession with the members of the Princeton faculty and the board of trustees at the opening of the exercises.

After John Grier Hibben, president of the university, had spoken of the development of engineering at Princeton and its future possibilities, Dean Arthur

M. Greene, Jr., of the Engineering School described the curricular plan of the engineering course, saying that scientific subjects formed nearly half of the courses required and engineering about a third, while cultural subjects filled the rest of the prescribed curriculum.

Dexter S. Kimball, dean of the Engineering School at Cornell, spoke on "The Relation of the Engineering School to Industry," and M. S. Sloan, president of the consolidated electric companies of New York City and Yonkers, discussed what a public utility owes to its customers, as reported in the ELECTRICAL WORLD last week (page 1006).

New York Central System Electrification Plans

President Crowley, Addressing Chicago Electric Association Dwells on Varying Conditions That Obtain in Different Cities as Determining Factors

INTRODUCED by Samuel Insull to twelve hundred members and guests of the Electric Association at its annual dinner, held at the Palmer House, Chicago, on Nov. 15, President P. E. Crowley of the New York Central Lines alluded to present and future plans for electrification on that railroad system, laying especial stress on what he held to be radically different conditions in the various large cities served by it and their effect on the electrification of terminals. Mr. Crowley said in part:

We are just entering into a third major installation of electric power upon the New York Central Lines—this time in and about Cleveland. As in Detroit, the work is being done in connection with a passenger station development which involves considerable underground operation and which, I believe, specially invites the use of electricity. On the other hand, in the new passenger terminal now nearing completion in Buffalo and in the proposed Union Station at Cincinnati there is no immediate need for electrification, as the trains will be operated in the open.

In other words, Cincinnati presents one problem, New York another and Chicago still another. Each differs from the others, as may be said of almost every city on our system. Each has problems of its own, and the local situation must be studied most carefully to develop the lines along which we should move to best serve each particular community, and not with the thought that what has been done in New York, or anywhere else, is the right thing to do at any other place. In Chicago a prime essential of the operating problem of the many railroads that enter the city is the expedited interchange of freight.

We are also experimenting with self-contained electric types of motive power which can operate either from wayside current, or, where such is not available, by electricity which is produced by a Diesel power plant on the locomotive itself. We hope these experiments will result in the availability of a satisfactory unit of power, economically reasonable in cost and obsolescence as well as operation and maintenance, with which to meet the requirements which may develop from time to time in this general field of operation, particularly industrial switching within congested municipal limits.

We have additional experiments in progress with advanced types of motive power for various fields of operation so that we may obtain first hand knowledge of their relative merits and availability and economic value for our diversified service geographical and traffic conditions.

Samuel Insull and L. A. Ferguson

On the day before the meeting of the Electric Association Mr. Insull and Mr. Ferguson had, as reported last week, spoken at the ceremony in commemoration of the twenty-fifth anniversary of the opening of the Fisk Street station of the Commonwealth Edison Company.

Coal-Firing Problems from Many Angles

Low-Temperature Carbonization, Pulverized Fuel, Ash Removal and Clinkering Among the Topics First Presented at Bituminous Coal Conference in Pittsburgh

IN WELCOMING the thirteen hundred delegates from nearly twenty countries to the second International Conference on Bituminous Coal, held in Pittsburgh this week, President T. S. Baker of the Carnegie Institute of Technology and T. P. Gaylord, vice-president of the Westinghouse Electric & Manufacturing Company, frankly conceded that too much efficiency on the part of the consumers of the product was a large factor in the depression existing in the coal-mining industry. "This conference may reveal to the coal-mine owner that his product may be used even more sparingly in the production of power, but it should show him that the same sort of ability that has narrowed his markets can discover the means of enlarging them," said President Baker, who foresaw the coal car giving way to the power line and pipe line.

Low-temperature carbonization as one phase of the work of the British Fuel Research Board was reported upon by C. H. Lander of England, who deprecated both groundless optimism and unnecessary pessimism concerning this process, suggesting that only time can tell to what degree it may develop as an important factor in the economy of the world's fuel. W. A. Darrah formulated the economics of low-temperature coal treatment and the possibility of the coal producer entering the field of power production and selling electric power either by acquiring an interest in existing central-station plants, forming alliances with existing distributing companies or entering the field directly in order to improve the mine load factor. Performance data covering an American commercial low-temperature-carbonization plant were offered by James Balph of the Coal Carbonization Company. George E. K. Blythe of England spoke of the engineering problems involved in firing pulverized fuel and stressed the importance of the proper design of burners and pulverizing equipment.

Pulverized fuel was again a major topic in Tuesday's sessions. Henry Kreisinger of the Combustion Engineering Corporation pointed out the inherently greater difficulties involved in the burning of pulverized coal as compared with gas or oil and demonstrated the essential importance of thorough mixing of air and fuel by turbulence and adequate time valves. James W. Armour of the Riley Stoker Company, in discussing modern stokers, said: "The greatest single factor in recent stoker development can be traced almost entirely to competition of pulverized-coal firing." Mr. Armour compared costs and efficiencies of stoker and pulverized-fuel installations and conceded parity on every item except first cost, which he found favorable to stokers. P. Rosin of Germany analyzed the thermodynamic basis of pulverized-fuel combustion and said: "While fine grinding in power stations soon finds its economic limits and heat delivery in the combustion chamber allows only a limited lowering of temperature, the theoretical limits of turbulence and gas velocity lie far beyond practical endeavors, and therefore the aërodynamic conditions in the combustion chamber have to play the most important part in increasing load."

Ash removal and clinkering were among the subjects considered on Wednesday, a joint paper by D. S. Jacobus and E. G. Bailey being devoted to this topic with particular reference to the reduction in carbon loss and to the most recent plan for ash removal, namely, molten-slag draw-off. Flue-dust removal and the slagging of boiler tubes were topics similarly considered. Clinkering was the subject of an address by Thomas G. Estep, who condemned purchasing analyses which failed to take into consideration operating conditions in the consuming plant. Professor Estep said: "High sulphur content is not *a priori* evidence that the coal is undesirable." Other speakers on topics of interest to power-company men at this session were: Karl Bunte, who discussed a new method for the determination of melting processes in ash; I. P. Goosens, who dealt with the transportation of pulverized coal, and R. Lessing, whose topic was the rational cleaning of coal.

A report of Thursday's and Friday's sessions will be printed next week.

Purchases and Mergers

Central Gas & Electric Company's Maine Properties Are Consolidated—Massachusetts Light & Power Association's Group

PERMISSION has been granted by the Public Utilities Commission of Maine for the consolidation of ten properties in that state controlled by the Central Gas & Electric Company of Chicago with the Gould Electric Company of Presque Isle, which is also a Central Gas & Electric property. The merged companies are the Gould Electric Company, Ashland Electric Light & Power Company, Eastern Electric Company, Fort Kent Electric Company, Katahdin Electric Company, Maple Grove Electric Company, Mapleton Electric Company, Milo Electric Light & Power Company, Prestile Electric Company of Presque Isle, Sherman Electric Company and Stockholm Electric Light & Power Company.

The Massachusetts Light & Power Association, recently organized as a voluntary organization by the New England Power Association, is to be the holding company of the latter company for electric distributing companies throughout Massachusetts. Initial plans provide that the new company shall take over all holdings of the New England Power Association in the Lowell Electric Light Corporation, Lawrence Gas & Electric Company, Gardner Electric Company, Fall River Electric Light Company, Webster & Southbridge Gas & Electric and Quincy Electric Light & Power Company and a minority interest in the Worcester Electric Light Company, North Boston properties and several smaller distributing companies.

Three electric utility companies in New Hampshire owned by the Arthur F. Dewing interests and including the Baker River Light & Power Company, the Plymouth Electric Light Company and the West Campton Light & Power Company are seeking authority from the Public Service Commission to consolidate.

Application has been made by the Rochester Gas & Electric Corporation to acquire the Nunda (N. Y.) Electric Light Company. The Nunda company is supplied at the present time by the Genesee Valley Power Company, which is owned and controlled by the Rochester corporation.

The New York Public Service Commission has consented to the transfer by the Morris Light & Power Corporation of its franchise and property in the village of Morris, Otsego County, to the New York State Electric Corporation, which will also serve the town of Morris.

The Independence (Iowa) hydro-electric plant, formerly operated by the Northeastern Iowa Power Company, was recently acquired by the Central States Light Corporation and has been tied in with its power lines.

The Cities Service Company of New York has acquired the Tecumseh (Mich.) Electric Company from the Central States Power & Light Corporation of Chicago. The new property, which serves Britton, Ridgeway, Holloway and Deerfield, Mich., will be operated by a newly organized Cities Service subsidiary, the Lenawee County Light & Power Company.

Approval of the Kansas Public Service Commission is asked of the sale to the Kansas City (Mo.) Light & Power Company of the properties of the Municipal Power Transmission Company, headed by I. C. Bushong, with headquarters at Ottawa, Kan. These distribution properties, over which energy purchased wholesale from the Ottawa municipal plant has been supplied, are in Franklin, Douglas, Osage, Miami, Anderson and Linn Counties and include 21 small towns.

Sale to the Kansas Power & Light Company, Topeka, of the municipal distribution system of Mayetta, Kan., has been announced. Mayetta formerly received service from the Holton municipal plant.

The Gage County Electric Company of Beatrice, Neb., has bought the light and power plant at Jansen, Neb., from the municipality.

The electric light plant at New Underwood, N. D., has been sold by W. M. Bidwell to Roy Oliver of New Underwood. The latter will probably move the plant into quarters which he owns.

M. E. Mozingo and George Mack of Dodge Center, Minn., owners of electric light and power plants at Dodge Center, Hayfield and Waltham, in that state, including farm light and power lines radiating therefrom, announce the sale of these properties to the Federal Public Utilities Company of Chicago.

The electric light plant at Eagle Butte, S. D., has been sold by A. E. Chambers to the Citizens' Electric Service Company of Omaha. The plant will be enlarged by the addition of a 50-hp. motor.

Negotiations have been completed for the sale of the light and power plant at Crestview, Fla., to the Gulf Power Company of Pensacola for $37,000. Operation of the plant is expected to be continued until a transmission line through west Florida can be extended to Crestview.

Purchase by the People's Light & Power Company of New York of the electric light and power plants of the Weimar Power & Light Company at La Grange and Weimar, Tex., and of the plant owned by Emil Buescher & Sons at Smithville, Tex., has been announced.

H. M. Byllesby & Company have purchased certain Mexican properties, as noted on page 1070.

Three Senators Oppose Radio Station for Utilities

Three United States senators aligned with the critics of the light and power industry and private utilities in general appeared before the Federal Radio Commission on Nov. 16 to oppose the issue of a full-time license to station WENR of Chicago, operated by the Great Lakes Broadcasting Corporation, on the ground that this body was made up of utility companies and would broadcast propaganda. The station has hitherto shared time with WLS, operated by the *Prairie Farmer*.

Senator Norris of Nebraska declared that the radio activities of the utilities had "no other purpose than furtherance of an attempt to control public opinion" and that the request of the utilities station could be granted only at the expense of agriculture. Senator Brookhart of Iowa, agreeing with Senator Norris, asserted that if the commission granted the demand of WENR, it would be "giving a monopoly of the air in Chicago" to interests which opposed public ownership of utilities. Senator Walsh of Montana said: "I don't think that the utilities ought to be granted a license in the public interest of all."

Seattle Dispute Goes On

Puget Sound Company, with 300,000 Hp. in Steam Units Planned, Maintains that City's Water-Power Project Is Extravagant

OFFICIALS of the Puget Sound Power & Light Company announce that the company will start construction of a second five-million-dollar steam-power plant unit at Renton, Wash., immediately upon completion next September of the unit now under way. The unit under construction marks a departure of the power company from utilizing hydro-electric power—one undertaken for reasons of economy. The first Renton unit is expected to develop 50,000 hp. at a cost of from $100 to $110 per horsepower. The steam development program calls for six units at a total cost of $30,000,000, to be constructed as fast as the demand for power justifies. At the present rate, it is declared, the growth will demand a unit a year until the project is completed.

Puget Sound company engineers believe they could contract to furnish the city all the power it needs at a lower rate than the city can produce the power for and insist that, for the present at least, steam is more economical than water power; but Superintendent of Lighting J. D. Ross scoffs at this suggestion. He asserts that the city is prepared to meet any reduction in rates that the Puget Sound company may be able to effect.

The company, disputing this, declares that the city is committed to a sixteen-year program of hydro-electric development that will have cost nearly $25,000,000 at the end of three years. The city has $11,995,000 invested in the Skagit hydro-electric project, yielding only 50,000 hp. at the present time, as contrasted with the five-million-dollar investment of the power company in the steam plant to yield an equal amount. This comparison, however, Superintendent Ross says, is unfair in that much of the investment by the city in the Skagit project is preliminary to the full development of the 1,125,000 hp. potentially available. The city is obligated also for $12,015,000 additional expenditure, which, Mr. Ross says, would yield the city, under present plans, 205,000 additional horsepower in three years.

That the Diablo power plant and a second transmission line from the Skagit plant to Seattle are to be placed ahead of all other city construction projects and rushed to completion is definitely indicated by an ordinance now before the City Council. The bill amends a previous ordinance which authorizes preliminary surveys and studies for a permanent diversion dam at Gorge Creek, a power house and tunnel at Diablo, an additional transmission line from Diablo to Seattle, and a generating plant at Lake Youngs in the Cedar River watershed. These surveys, the ordinance stipulates, are to be made by City Engineer W. D. Barkhuff and the Constant Angle Arch Dam Company, which fills the function of city consulting engineer.

For Regulation of Holding Companies

State Commissioners' Association Committee So Declares at New Orleans—Rates Are Not Flexible Enough—W. A. Prendergast and M. W. Harrison Talk

AMONG the committee reports submitted and discussed at the New Orleans meeting of the National Association of Railroad and Utilities Commissioners—held from Nov. 13 to Nov. 16 and summarized last week as regards its reaction to the public utility investigation now under way by the Federal Trade Commission—those of chief interest to the electric light and power industry concerned generation and distribution of electricity, public ownership and operation, service of public utility companies, public utility rates, capitalization and intercorporate relations, and safety.

Operation and Distribution Costs

That the general trend of all costs of generating and distributing electric power over a fifteen-year period has been downward, although the downward movement is not uniform or uninterrupted by upward swings, was the conclusion reached by the committee first named, which was a special one headed by Adolph Kanneberg of Wisconsin and which based its conclusions mainly on a study of the electric systems in that state. The decreases have been usually greater for the small systems than for the larger ones, so that the margin of advantage of the large over the small systems has contracted noticeably. Another significant feature is that, while large systems still have a considerable advantage in generation costs over the smaller systems (particularly as between large and small steam plants), the costs connected with distributing systems of all sizes seem at the present time to be nearly the same. The concentration of distribution, utilization and commercial expense, particularly, shows a standardization of the expenses incurred in disposing of the product.

Three points, the committee reported, stand out in regard to generating costs. First, generating costs were the largest single group of expenses, except for the large water-power systems, throughout the period from 1922 to 1927. Second, these are composed very largely of a single item—superintendence and labor for water-power and fuel for steam systems—and fluctuate almost exactly in sympathy with changes in these items. Third, they decrease very consistently as the volume of output increases.

The committee on public ownership and operation reported that the sentiment of the association on this point has unquestionably become crystallized into one of general opposition. The committee again expressed its belief in individual initiative and opportunity, the inherent rights of millions of private investors and the principle of private ownership and operation under proper governmental regulation.

The committee on service of public utility companies reported that their growth and expansion had been as marked during the past year as in those preceding it. It spoke of the adaptation of this service to new uses and told how research has created appliances whose product has become a necessity in almost every field of human endeavor.

Discussing the rate base as the essential factor, the committee on public utility rates reported a strong tendency on the part of owners of public utilities to insist that the fair value is the cost to reproduce new less actual depreciation plus "going-concern" value and working capital. This tendency, the committee said, has been stressed to such a degree that it has become alarming. Historic cost, the committee held, should be consulted in determining fair value. It is one check against wild estimates. "We cannot deny," the report said, "that the public believes utilities to occupy a position of preference in our social structure. It is beginning to feel that rates, coupled with other advantages which utilities have under the law, are too high."

Voluntary reductions of rates have, however, been plentiful in the past year, the committee admitted. The Pennsylvania plan for extension of rural lines has formed the basis for a marked increase of service to rural communities, and the committee believed that other regulatory bodies should encourage the use of the Pennsylvania and similar methods, with such variations as are found adaptable to the communities served. That rate schedules in general should have greater flexibility was the committee's conclusion.

Holding-Company Regulation

The committee on capitalization and intercorporate relations reported that holding companies should be defined as "public utilities" and be made subject to such regulation as may be necessary. The committee appreciated that mere legislative enactment will not make a public utility of a corporation that is not in fact a public utility. It believed, however, that in all instances where the holding company and its subsidiaries affect the control and activities of the operating company they may, and should, be considered as public utilities in fact. Since virtually all utilities desire a continuance of the present system of state regulation, it is incumbent upon them to use every endeavor to avoid a situation which might result in a public demand for a change, and utilities favoring effective regulation will recognize the necessity for such amendments to state commission acts to this end.

No class of industry has been more diligent in safeguarding its employees than public utility companies, the committee on safety operation reported.

William A. Prendergast, chairman of the New York Public Service Commission, told the members that the activities of holding companies are responsible for much of the suspicion entertained by the public in its relations with the public utility industry. Declaring that in most cases electric utilities have had substantial justice from the state commissions, Mr. Prendergast answered what he construed as a charge by Philip Cabot, professor of public utilities in the Harvard Business School, that oppressive policies by state commissions have forced holding companies to resort to devious ways to secure extra profits from operating companies. "If rates have been found to be too low," he said, "the electric utilities have not been afflicted with any shrinking modesty in asking that a fair profit or return be allowed to them. There is sound objection to the idea that contracts for service of different kinds may be made between the holding and the operating companies without any public regulation. We also know that the industry has stubbornly resisted the imposition of regulation upon the holding companies, and this in itself does not promote public confidence."

M. W. Harrison's Address

In an address by Milton W. Harrison, president National Association of Owners of Railroad and Public Utility Securities, it was maintained that the function of regulation is to check bad tendencies, to correct evils which may injure service and credit, to insure reasonable charges, and to arbitrate differences between groups of interests. These functions and those of management being entirely distinct, there is every reason for co-operation.

"We are in a period of changing conditions," the speaker declared, "at the cross roads, so to speak, and must decide whether we will enter upon the road toward government ownership or continue in the path of private ownership. For my part, I would not take the former, which might seem to be the easier way. It is true that to travel the path of private ownership, and to maintain equilibrium between regulation and regulated industries, will require greater intelligence and more scientific treatment. But the benefits to the public will be infinitely greater than under government ownership. . . .

"A spirit of hostility toward the industries upon which our economic and industrial progress is so dependent should not be engendered by an assumption that utilities generally are guilty of misconduct before they are proven so. If certain practices not regarded as in the public interest have been made possible because unwieldy legislation has impeded regulation, should not the sponsors of such legislation shoulder their responsibility? If there is accurate knowledge of subtle and insidious propaganda on the part of those who favor experimenting with government ownership as a panacea, in justice why should there not be every effort on the part of those who believe sincerely in the proven benefits of private ownership to sustain that belief before the public?"

West Texas Utilities Plans 60,000-Hp. Development

An application has been filed by the West Texas Utilities Company with the Texas State Board of Water Engineers for a permit to impound 2,500 acre-feet of water annually on Lytle Creek, near Abilene, to provide water power for a hydro-electric plant which it desires to construct at a cost of $5,000,000. Public hearing on the application will take place Nov. 26. The new plant will be about a mile and a half from the present dam, which is two miles east of Abilene, and will be much the largest owned by the company, with three units developing 20,000 hp. each. The dam will impound 2,200,000,000 gal. If the permit is granted, work will start on the dam next fall and the plant will be erected in 1930.

Since Jan. 1, 1927, the West Texas Utilities has added 38 towns to its list, making 104 communities and more than fifty thousand customers now served by it with light and power. These towns are situated in 40 counties which have an aggregate population of 550,000. In this time the company has extended its transmission lines from 860 to 1,832 miles and raised its connected load from about 50,000 kw. to almost twice that size. A large part of the new lines are operated at 66,000 volts, and the company is now building a line at that voltage from Wellington to Shamrock. Building records were made. One stretch of 100 miles, from Mertzon to McCamey, was put into service in 60 days after its construction began. Among other improvements made by the company since Jan. 1, 1927, most of which have been already noted here, have been the rebuilding of the San Angelo generating station, where two 6,400-kw. turbo-generators were put in operation; building of a 15,000-kw. unit of an ultimate 40,000-kw. generating station at Lake Pauline, near Quanah, and completion of smaller generating stations at McCamey, Clarendon, Sonora and Quitaque.

Electric Division, Farm Engineers, to Meet in Chicago

Nine papers and five round-table sessions will make up the program of the Rural Electric Division of the American Society of Agricultural Engineers, which will hold sessions at the Hotel Sherman, Chicago, on Dec. 6 and 7, following two days devoted by the society to power and machinery. The nine papers will be given on the first day and include:

Morning—"Farmstead Wiring for Electricity," H. S. Hinrichs, Kansas Power & Light Company; "The Wiring of Farm Buildings," C. W. Abbot, Rome Wire Company; "Electric Motor Installations," J. W. Savage, General Electric Company; "Installation of Water Systems," F. W. Duffee, University of Wisconsin.

Afternoon—"Feed Grinding on the Farm," E. R. Meacham, Wisconsin Power & Light Company; "Dairy Refrigeration—Equipment and Use," M. B. Cann, Eastern Sales Corporation; "Retail Dairy Refrigeration," Truman E. Hienton, Purdue University; "Seed-Corn Testing," Prof. E. W. Lehmann, University of Illinois; "Ventilation by Electric Fans," H. S. Nesbit, Ilg Electric Ventilating Company.

The entire second day will be given over to group or round-table conferences. These will include one on rural load building by merchandising, led by Charles P. Wagner, Northern States Power Company, and one on demonstrations and exhibits, led by Richard Boonstra, Public Service Corporation of Northern Illinois. There will also be conferences on silo filling and grain and feed elevators.

Arizona's Attitude Maintained by Coming Executive

A renewed assault on the Swing-Johnson Boulder Canyon Dam bill with the opening of Congress this winter was promised by the Arizona State River Commission after a series of meetings which ended last week. Governor-elect John C. Phillips and Senator Carl Hayden met with the commission, and a statement given out by the secretary at the close of the conference indicated that the new Governor will be opposed to any Colorado River development along the lines set forth in the bill sponsored by the California men.

The statement said that "the recent election did not alter the situation in any particular. There appears to be no difference between the views of Governor-elect Phillips and the principles which have guided the river commission since its appointment." While the commission pledged itself to "leave no stone unturned in our efforts to defeat the Swing-Johnson bill in its present form," it also said that "nothing within the commission's power shall be left undone to effect the reaching of a just agreement between the states upon which the sensible, fair and equitable development of the river may be predicated."

Governor George H. Dern of Utah and the three other upper basin Governors plan to meet in Denver before December to argue the question of water division. Governor Dern is quoted as believing that the Swing-Johnson bill will be passed in the short session of Congress.

Chamber of Commerce and Water Power

Special Committee Representing Engineers as Well as Industrial, Financial, Utility and Farming Interests Meets at Washington and Debates Policy

By Paul Wooton

Washington Correspondent for the Electrical World

IN ORDER to gather advice preliminary to a definite and constructive stand on modern power problems, the Chamber of Commerce of the United States has set up a national water-power policies committee. This committee convened in Washington on Nov. 12.

On the committee, which has been selected to include outstanding men from all branches of business directly concerned as well as engineers, there are representatives of financial, railroad, farming equipment, fertilizer and other interests. It is composed as follows:

Frederic A. Delano, former member of the Federal Reserve Board and railway executive, Washington, D. C.

Thomas S. Baker, president Carnegie Institute of Technology, Pittsburgh.

Arthur S. Bent, president Bent Brothers, Inc., Los Angeles.

Frank P. Glass, publisher and editor, Montgomery (Ala.) *Advertiser*.

Lafayette Hanchett, president Utah Power & Light Company, Salt Lake City.

David C. Henny, consulting engineer, Portland, Ore.

Horace W. King, professor hydraulic engineering, University of Michigan, Ann Arbor.

Alexander Legge, president International Harvester Company, Chicago.

Charles H. McDowell, president Armour Fertilizer Works, Chicago.

Frank I. Mann, Bois d'Arc Farm, Gilman, Ill.

Harold G. Moulton, president Brookings Institution, Washington, D. C.

R. E. Norton, vice-president C. H. Geist Securities Corporation, Philadelphia.

Warren Olney, Jr., attorney, San Francisco.

Lewis B. Stillwell, consulting engineer, New York.

Gen. Harry Taylor, former Chief of Engineers U.S.A., Washington, D. C.

The first day of last week's meeting was given over to a round-table discussion of those features of hydro-electric power development with which the committee might now constructively deal. These include government versus private ownership and operation, federal and state functions as to jurisdiction and regulation, relation of hydro-electric power to other water uses and to fuel electric power, a proper measure of water-power resources and practicability of development, and present national policies as laid down in the federal water-power act. Attention was also given to those features of water-power development which have resulted in efforts to obtain special legislation for such projects as Muscle Shoals and Boulder Dam, resulting in the withdrawal of great watersheds like those of the Tennessee and Colorado Rivers from active development.

On the second day O. C. Merrill, executive secretary of the Federal Power Commission, and Colonel William Kelly, vice-president of the Buffalo, Niagara & Eastern Power Corporation, appeared before the committee and expressed their

views on several of the matters above outlined. Mr. Merrill emphasized the great desirability of leaving as much of the creation and administration of policies in the hands of the several states as the states are willing and equipped to undertake. Colonel Kelly emphasized the need of a sane public understanding on water-power possibilities.

The third day was devoted to the selection of features of national water-power policies for study by members of the committee. Some suggestions were made as to constructive recommendations which the committee might ultimately make to the chamber's board of directors. Chairman Delano, it is understood, plans to call the next meeting of the committee some time in January.

W. Dub Brookings, manager natural resources production department of the national chamber, is acting as secretary to the water-power committee, assisted by D. J. Guy, hydro-electric engineer on the chamber's staff.

For and Against Hydro Plant at Falls of Potomac

While opposing power development at the Great Falls on the Potomac, near Washington, at the present time and advocating the acquisition by the government of the site for park purposes, the committee appointed by the National Capital Park and Planning Commission to study the situation would leave the way open for power production at a later time should this then seem more urgent than park preservation. In the committee's report, completed recently, the position is, however, taken that even the modified plan for power development, arranged specifically to fit in with the plans for creating a park in the region, would entail damage to scenery and is not acceptable.

Advocates of utilizing the water power at Great Falls for the generation of electricity have estimated that more than a billion kilowatt-hours of primary power would be available about half the time. This power can be produced, it is claimed, at a cost from 20 to 25 per cent less than is possible at any steam plant in the same locality. Advocates of the power project also believe that it could be made a factor in beautifying the region.

Major Brehon Somervell, government engineer for the Washington district, has completed a report on the application by Byllesby interests for a preliminary permit at Great Falls. Major Somervell's report, which it is understood favors the power plan, will be submitted to the Chief of Engineers in the near future and later will be sent to the Federal Power Commission. The report of the committee of the National Capital Park and Planning Commission will be considered by that body before it is finally approved and sent to the Federal Power Commission. It is believed that this will require several weeks.

Briefer News

LIGHTING UP THE ALABAMA POWER COMPANY'S HEADQUARTERS.—By floodlighting the topmost three floors and adding the effect from lavish interior illumination additional beauty has been lent at night to the Birmingham headquarters of the Alabama Power Company. Since it was made ready for occupancy in the fall of 1925 the building has been one of the showplaces of the city. Beginning with the balconies of the twelfth and thirteen floors, 44 500-watt projectors have been installed. They are so designed as to give a wide diffusion of light on the walls above

the balconies. Around the fourteenth floor 72 100-watt and six 500-watt projectors have been installed back of the parapet walls to illuminate the mission tile roof and elevator penthouse. Besides these, there are six 500-watt lamps for the lighting of the statue "Electra" which adorns the building's pinnacle and the diffusion of light over the roof. Equipment was furnished by the General Electric Company and installed by the Dixie Construction Company. Provision was made for later installation of colored lighting effects.

INSTITUTE MEETINGS FOR 1929.—The first regional meeting for 1929 of the American Institute of Electrical Engineers will be that of the Middle Eastern district, to be held in Cincinnati on March 20-22. There will also be regional meetings of the Southwest and the Great Lakes district, the former at Dallas on May 7-9, the latter probably in the first week of December, the city having not yet been selected. The annual summer convention of the Institute will be held at Swampscott, Mass., on June 24-28. The winter convention will be, as usual, at New York City, the time being Jan. 28 to Feb. 1, and the Pacific Coast convention in the summer.

SNOW MOUNTAIN POWER COMPANY PROGRAM.—The extension program of the Snow Mountain Water & Power Company in the Upper Napa Valley, Calif., costing nearly half a million dollars, has been completed. Power from the Eel River plant of the company is now serving all of the valley district, including the towns of Calistoga, St. Helena and Yountville.

MISSOURI POWER COMPANY TO BUILD 150-MILE TRANSMISSION LINE.—The Missouri Power Company in the coming winter will erect a transmission line along United States Highway No. 66 from Marshfield to Cuba, Mo., a distance of more than 150 miles. Towns along this highway to be served by the new line include Conway and Phillipsburg. Construction is now under way on a 33-mile line from Ash Grove to Marshfield, Mo.

ST. LOUIS' NEXT STREET-LIGHTING EXTENSION.—The St. Louis Board of Public Service will on Dec. 11 open bids for the installation of an electric street-lighting system in District F, between Oakland Avenue, Page Avenue, Newstead Avenue and the western city limits. In all 2,200 standards with 250-cp. lamps, will be installed at an estimated cost of $465,000. This is another step in the city-wide installation that is revolutionizing street lighting in St. Louis.

TURNERS FALLS ENERGY GOES TO MASSACHUSETTS HILL TOWNS.—The Hampshire Electric Company, recently formed by citizens of the hill towns of the western section of Hampshire County, Mass., and now serving the towns of Cummington and Worthington with energy delivered by the Turners Falls Power & Electric Company at West Chesterfield, purposes soon to extend the service to Plainfield and Becket for home lighting and the use of small industrial establishments.

NEBRASKA LEAGUE FIGHTS FOR PRESERVATION OF MUNICIPAL PLANTS.—Declaring that the disappearance of municipal lighting plants would subject the "people to constant exploitation by a powerful monopoly," the League of Nebraska Municipalities has announced a legislative program designed to give "additional protection to the smaller towns that have been the object of a concerted drive by power companies to buy up their plants." Among the main features of the legislative proposal will be a requirement that no municipal plant may be sold except by a vote of the people, limitation of private-company franchises to fifteen years, limiting street-lighting and water-pumping contracts to five years, and prohibiting sale

or lease except when authorized at a special election following appraisal by a qualified engineer. The league indorsed a large number of legislative candidates who had given a pledge to support such legislation.

ELECTRICAL SHOW AT RICHMOND, VA., SCORES SUCCESS.—Richmond's first annual electrical exposition, held at the Mosque, came to a close on Nov. 10 with more than five thousand people jammed into the hall. John W. Gates, the director, declared that in point of attendance and city-wide interest the Richmond exposition surpassed similar shows held in other cities, and the Electrical League at Richmond, which sponsored the show, expressed the view that it was an entire success.

OTTUMWA, IOWA, HAS PLAN TO MAKE POWER PLANT PAY FOR STRAIGHTENING RIVER.—Ottumwa, Iowa, is seeking a permit to allow the city to straighten the channel of the Des Moines River in its flow through the city, this movement being in the cause of flood protection. Horace A. Brown, superintendent of the Ottumwa waterworks, has a plan involving the installation of a hydro-electric plant. By this means, it is held, the cost of the project, which would be approximately $1,000,000, could be reimbursed.

JERSEY CENTRAL POWER & LIGHT SAID TO CONTEMPLATE BUILDING GENERATING STATION AT SOUTH AMBOY.—A press report says that the Jersey Central Power & Light Company has purchased property at South Amboy, N. J., on which it will erect at a cost of $4,500,000 a steam generating plant with an initial rating of 50,000 kw. No confirmation of this report, however, could be obtained from the National Electric Power Company, New York, which now controls the Jersey Central company for the Insull interests, beyond a statement that expansion plans have for some time been under consideration.

CHANGE OF DAM SITE IN FIFTEEN-MILE FALLS POWER PROJECT.—The Public Service Commission of New Hampshire has issued an order granting a request from the Grafton Power Company for permission to change the site of its proposed lower dam at Monroe in the Fifteen-Mile Falls stretch of the Connecticut River, where the great hydro plant backed by the New England Power Association is beginning to take shape. The new site is a short distance up the stream and on the Vermont side of the river, whereas the first site approved was on the New Hampshire side.

ELECTRIC DEMONSTRATION FARMS RECOMMENDED FOR OKLAHOMA.—The Oklahoma Farm Electrification Committee, meeting at Oklahoma City recently, adopted a resolution recommending that electric light and power companies in Oklahoma designate certain farms lying in their territory as electrification demonstration farms, these farms to be, wherever possible, on main highways, and that signboards be erected designating their purpose and inviting all interested to inspect them. Representatives of light and power companies reported that there is a growing and insistent demand from farmers for electric service. Although use of electricity in rural communities, they said, is at present largely confined to household purposes, service is being expanded rapidly to other farm uses.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for July 7, page 48.]

American Society of Mechanical Engineers—Engineering Societies Bldg., New York, Dec. 3-7. C. W. Rice, 29 West 39th St., New York.

American Society of Agricultural Engineers — Rural Electric Division, Hotel Sherman, Chicago, Dec. 6-7. Raymond Olney, St. Joseph, Mich.

Electrical Credit Association — New York Division, New York, Dec. 17; W. J. Kreger, 261 Broadway, New York.

North Central Electric Association—Engineering Section, Minneapolis, Jan. 21-22. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

American Institute of Electrical Engineers—Winter convention, New York, Jan. 28-Feb. 1. F. L. Hutchinson, 33 West 39th St., New York.

Midwest Power Conference — Chicago, Feb. 12-16. G. E. Pfisterer, 53 W. Jackson Blvd., Chicago.

THIRTY-MILLION-DOLLAR HYDRO PROJECT FOR SAN JOAQUIN VALLEY.—Another step toward the thirty-million-dollar hydro-electric power project in Tulare County, Calif., was taken last week when the Empire Development Company of San Francisco, which has made, as reported already, an application for a preliminary permit to the Federal Power Commission, applied to the State Division of Water Rights for permission to divert water from San Joaquin Valley streams. The company seeks to divert 600 sec.-ft. from the North and South Forks of the Kern River and Golden Trout Creek and to impound 350,000 acre-feet of water a year through a system of dams and tunnels. Electric power would be sold to existing distributing companies of the San Joaquin Valley, the application states.

TENNESSEE ELECTRIC POWER COMPANY EXTENDS TRANSMISSION LINES.—Contracts have been let by the Tennessee Electric Power Company and its subsidiary the Nashville Railway & Light Company for the construction of substations and transmission lines at an estimated cost of $1,500,000. The lines will run east and south from Nashville through Centerville to Hohenwald and from Centerville north to McEwen. Fifty-eight miles will be steel-tower construction, of which 14 miles will be double-circuit. There will be 51 miles of wooden-pole construction. The conductors throughout will be aluminum steel-core. The substations will be in Nashville, Centerville, McEwen and Hohenwald, and the existing South substation in Nashville will be enlarged. This work is being carried out by Stevens & Wood, New York.

LEAGUE CONFERENCE SET FOR JANUARY AT CLEVELAND.—At the headquarters of the Society for Electrical Development a meeting of the newly elected League Council was held recently, presided over by Chairman R. Bourke Corcoran. Among the matters considered were the midwinter conference, Christmas activities, the Industry Sales Conference and the commercial and industrial lighting plan. Excellent progress was reported in these directions as well as in home modernization and work with contractor groups. It was decided to hold the second midwinter conference of secretary-managers of leagues in Cleveland on Jan. 7 to 9. The business sessions will be held at the headquarters of the Electrical League of Cleveland. Official headquarters will be at the Hotel Statler.

MONONGAHELA-WEST PENN IMPROVEMENT PROGRAM.—To improve its electric service at many points, the Monongahela-West Penn Public Service Company is embarking on the largest construction program since its steam power station was built at Rivesville, W. Va., in 1918, according to an announcement by the company. The program includes the building of new transmission lines and other expansions to involve the expenditure of $1,000,000. The largest item will be a 132-kv. line from Rivesville by way of Hutchinson and Clarksburg to Parkersburg. A 15,000-kw. substation will be erected east of Parkersburg, new equipment will be added to the Hutchinson substation, and new transmission lines will be built from the new Parkersburg substation to connect with the present system at that point.

FORTY-ONE APPLICATIONS FOR OREGON POWER SITES FOLLOW DEFEAT OF LAW TO CLOSE STATE'S CHIEF RIVERS.—Complete returns of the vote in Oregon on closing to further hydro-electric development the Rogue, Umpqua, Mackenzie and Deschutes Rivers, in the supposed interest of fish preservation, confirm the first reports that, thanks to the agricultural vote, the four initiated measures were defeated by two to one at the general election on Nov. 6. On the day following the announcement of the election returns the State Engineer received 41 applications for water permits, among them being one from Albert Anderson, Eugene, asking authority to store 18,700 acre-feet of water from the South Fork of the Coquille River and to appropriate 75 sec.-ft. of this water for the development of hydro-electric power in Coos County. This proposed development is in the operating field now occupied by the Mountain States Power Company. Herman Kolberg of Portland filed application for a permit to store 150,000 acre-feet of water from

Salmon Creek and tributaries and appropriate 2,500 sec.-ft. for power purposes. The district indicated in this application is considered the operating field of the Portland companies.

DEDICATION OF PHYSICS LABORATORY AT UNIVERSITY OF MINNESOTA.—A meeting of the American Physical Society will be held on Nov. 30 and Dec. 1 at the University of Minnesota, Minneapolis, at which time the new physics laboratory of that institution will be dedicated. There will be a "dedicatory symposium" at which papers will be presented by prominent scientists, among them one on "Motions of Positive Ions in Ionized Gases" by Dr. Irving Langmuir and one on "Scattering of Electrons" by Prof. K. T. Compton. The dedicatory address, by Prof. John Zeleny, will describe "The Place of Physics in the Modern World."

SUB-METERING AT WASHINGTON.—The Operative Builders' Association of Washington, D. C., is opposing efforts made by the Potomac Electric Power Company to stop the practice of submetering in the capital. The association, through its executive secretary, charges that discrimination exists, some owners of buildings having been allowed to continue the practice and others having been ordered to stop it. It demands that the Public Utilities Commission give a public hearing on the matter. The association maintains that the practice is legal and that owners of buildings who have refused to discontinue it are within their rights.

COMMITTEE SET UP TO "SAVE OUR SCHOOLS." — Avowedly prompted by testimony before the Federal Trade Commission regarding literature furnished by utility companies to public schools, a national "Save-Our-Schools Committee" has been organized to combat "propaganda by special interests, groups or causes" in American schools and colleges. Mercer G. Johnston, the secretary, announces that the committee "contains 70 men and women, among them faculty members of Columbia, Harvard, Yale, Mount Holyoke, Chicago, Wisconsin, Michigan and other universities." Names published include also other well-known persons.

Commission Rulings

PROMOTIONAL RATES APPROVED.—In approving an electric rate schedule drawn for the purpose of stimulating consumption by small domestic customers through the medium of modern heavy-duty electric appliances, and in which a unit of three rooms was adopted as a basis, the charge being increased for each additional room to the limit of ten, thereby obviating any necessity for extra meters and making every outlet an appliance outlet, the Alabama Public Service Commission termed this plan a "promotional" rate and went on to say: "A 'promotional' rate for utility service has been defined as a rate which successfully develops an increasing volume of profitable business. This end is attained when each customer is offered an opportunity to use additional service at a low follow-on rate for energy consumed. In order that a really low energy rate may be offered to every customer, it becomes necessary to establish a relatively high charge for an initial small block of energy, which initial charge is also a minimum charge to cover partially the fixed costs of service such as setting and removing meters, meter repairs, meter reading, bookkeeping and collection expenses, interest charges on services and meters, and similar costs which exist for each customer whether or not any energy is actually used."

PROTECTING THE FARMERS AGAINST EXPLOITATION.—A general order has been entered by the Indiana Public Service Commission requiring any person or company desiring to construct or operate electric properties to submit to the commission for its approval a full description of the project before attempting to collect any money or taking any other actual steps. Explaining the reason for this order, the commission said: "In many places in the state persons desiring to engage in speculative enterprise have, without either engineering experience or financial ability behind them, come into many rural communities in the state and, by misrepresenting the facts, have collected money from unsuspecting persons for so-called 'connection charges' for connecting them to electric transmission lines which have never been started. In certain instances they have either failed to build lines which would supply satisfactory service or have built them in such manner as to constitute a menace to the lives and safety of the people generally. In most cases money enough to pay for the entire cost has been donated by prospective patrons."

COMPETITION AND EXCESSIVE PRICE FOR ACQUISITION OF SINGLE OPERATING UNITS CONDEMNED.—In refusing to the New York Power & Light Corporation permission to acquire the Ticonderoga Electric Light & Power Company, the New York Public Service Commission said: "The reason given does not seem to justify the price proposed to be paid for the stock of the Ticonderoga company at more than four and one-half times any possible valuation thereof based on the appraisal, which valuation is considerably higher than book value. While not of record in this case, it is common knowledge that there is at present in the State of New York a competitive struggle between several large utility corporations for the acquisition of the property and franchises of single electric distributing units. This competition seems to have induced the offering of prices for these single operating units beyond the possibility of any reasonable return thereon. Such a condition is certainly not in the interest of the public, and it is hard to conceive how it is in the interest of the stockholders of the companies making the offers. Probably it is not the duty of this commission to act in the interest of the stockholders, who are represented by boards of directors selected by them. It is, however, clearly the duty of this commission, under Section 70 of the Public Service Commission law, to make thorough examination of the facts and protect the interests of the public, and where the price to be paid is greatly in excess of the fair value of the property represented by the stock, it is our opinion that the public interest requires the disapproval of the application, unless it be shown that a good and sufficient reason for the granting of the petition exists independent of the fair value of the property and that the consuming public will be benefited thereby. While the granting of the present application might not permit the petitioner to use the purchase price as a rate base in a subsequent proceeding, we believe that the proposed purchase at a price so largely in excess of the fair value of the property represented by such stock is not beneficial to the public interest but detrimental thereto."

Recent Court Decisions

BOND ISSUE TO BUILD SELF-SUSTAINING MUNICIPAL PLANT AUTHORIZED. — The Colorado Supreme Court has sustained the city of Haxtun in an action brought against it by citizens to prevent the issue of bonds to the amount of $18,000 for the reconstruction and enlargement of the municipal electric light plant. The opposing taxpayers held that the city could not afford the bond issue. The city maintained that the plant would be self-sustaining. The lower court agreed with them and the Supreme Court is of the same opinion.

RIGHT TO IMPOUND WATER WILL NOT JUSTIFY NUISANCE CAUSED BY MAINTAINING FOUL POND.—In Ivey vs. Bainbridge Power Company, the Court of Appeals of Georgia decreed that the right to construct a dam and impound water does not carry with it power to create a nuisance by the maintenance of foul water in the pond or to permit mosquitoes to breed, to the damage of persons living in the neighborhood. Where a nuisance is of a permanent character, the court said, the person injured may recover damages past and prospective. Recovery of damages for decrease in the value of land resulting from the maintenance of a nuisance, however, must be confined to decrease from that cause, and any decrease brought about by a general slump of which the alleged nuisance was not the origin must be excluded. (144 S.E. 825.)*

PERMISSION TO ACQUIRE LEASED COMPANIES REFUSED. — The Public Service Electric & Gas Company, largest subsidiary of the Public Service Corporation of New Jersey, has been permanently enjoined by the Vice-Chancellor from acquiring five of its leased companies, on the ground that "minority stockholders face the possibility, if not the probability, of being cast into the discard by right of might and by means unwarranted and oppressive." Approval of the merger of the leased companies with the Public Service Electric & Gas was granted by the Board of Public Utility Commissioners of New Jersey in May, 1927, the five companies concerned being the Hudson County Gas Company, the Essex & Hudson Gas Company, the Paterson & Passaic Gas & Electric Company, the New Brunswick Light, Heat & Power Company and the Somerset, Union & Middlesex Lighting Company. "The merger, in effect, is nothing less than a forced sale by the majority stockholder to itself at a price fixed by it and payable at its pleasure," said the court. "The merger legislation countenances no such perversion."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

News About Electrical Men

J. H. SHEARER, vice-president in charge of operations of the Penn Central Light & Power Company, Altoona, Pa., returned from Europe last week after spending the month of October abroad. Mr. Shearer visited France, England and Belgium.

HOWARD T. SANDS, a vice-president of the Electric Bond & Share Company, arrived at Rio de Janeiro on Nov. 16, aboard the *American Legion*. Last year the Electric Bond & Share Company acquired public utility properties in Brazil and vested them in the American & Foreign Power Corporation.

LEVEN D. GRAY, formerly connected with the Dayton Power & Light Company, Dayton, Ohio, is now affiliated with the Union Electric Light & Power Company, St. Louis, Mo., in the capacity of steam distribution engineer.

WILL H. FISCHER has been made assistant to the president of the Southern California Edison Company, according to an announcement made by R. H. Ballard, president. Beginning his business career in newspaper work, Mr. Fischer has maintained an active interest in public affairs. Joining the Edison company in 1921, he has worked closely with President Ballard in all matters bearing upon public relations.

ALEXANDER SPEER, formerly connected with the Virginia Public Service Company as general manager of the southern Virginia properties, has been named vice-president and general manager of the Florida Power Corporation to succeed E. A. Olsen, resigned. Before joining the Virginia company Mr. Speer was connected with the New York office of the General Engineering & Management Corporation.

E. A. OLSEN, vice-president and general manager of the Florida Power Corporation, has resigned to affiliate himself with public utility interests in California. A graduate electrical engineer, Mr. Olsen was associated with the Virginia Public Service Company before affiliating himself with the Florida Power Corporation at St. Petersburg. Earlier in his career he was connected with the electrical industry in Georgia and Wisconsin. Mr. Olsen was chairman of the Florida Public Utilities Information Bureau.

JAMES W. ARMOUR has been elected vice-president of the Riley Stoker Corporation, with headquarters at Worcester, Mass. Mr. Armour was graduated in mechanical engineering in 1913 from the Worcester Polytechnic Institute, and after four years in the pattern-making business in that city, served overseas in the ordnance department, attaining the rank of captain in the Twenty-sixth Division, A.E.F. He entered the drafting department of the Riley corporation at Worcester in 1919, and after one year was transferred to the Detroit plant of that organization as inspector. He rose to the post of superintendent during the next five years and in 1925 returned to Worcester as engineering manager of the company.

F. V. Magalhaes to Assume New Duties in Philadelphia

F. V. Magalhaes, general superintendent of the distribution and installation department of the New York Edison Company in Manhattan, has resigned to become vice-president of engineering with the Hall Electric Heating Company, Inc. He will be located after Dec. 1 at the Philadelphia office. Mr. Magalhaes brings to this new position two years' experience with the Brooklyn Rapid Transit Company, a

F. V. Magalhaes

year's experience with the General Railway Signal Company of Rochester on design and experimental work on automatic railroad alternating-current signals and approximately twenty years in the central-station field since his graduation from the electrical engineering course of the Polytechnic Institute of Brooklyn. With the New York Edison Company he has successively held the positions of superintendent of the meter and installation department, superintendent of the test department and for the past three years general superintendent of the distribution and installation departments in Manhattan.

Mr. Magalhaes has always given actively of his time to committee work in various technical organizations, his present committee appointments including the chairmanship of the committee on safety codes of the American Institute of Electrical Engineers, carrying with it representation of that body on the electrical committee of the National Fire Protection Association, and the vice-presidency of the United States National Committee of the International Electrotechnical Commission. He is past-chairman of the national meter committee of the National Electric Light Association, of the metering and service methods committee of the Association of Edison Illuminating Companies, of the instruments and measurements committee of the American Institute of Electrical Engineers and past-secretary of the United States National Committee of the International Electrotechnical Commission.

Obituary

Samuel G. Rhodes

Samuel G. Rhodes, general superintendent of the distribution and installation department of the New York Edison Company since 1921, died suddenly Nov. 22 at his home in Brooklyn, N. Y. Mr. Rhodes was ill only a half an hour, when he succumbed to a heart attack. Mr. Rhodes had been a member of the engineering staff of the New York Edison Company since 1891, when he entered its employ as a wireman. Rising through the ranks, he became superintendent of the arc-light department, engineer of the meter and test departments and in 1920 he was appointed assistant to Vice-President John W. Lieb. The following year, when the distribution and installation department was organized, in addition to his former duties Mr. Rhodes assumed the general superintendency of the new department. For a number of years he had served on various technical committees of the National Electric Light Association, the American Institute of Electrical Engineers and the Illuminating Engineering Society. In addition he conducted a considerable amount of original investigation for the New York Edison Company on illumination, particularly in connection with street and park lighting. He was a fellow of the A.I.E.E.

EDWIN WALES ROBERTSON, prominent banker of Columbia, S. C., and a pioneer in the public utility field, died Nov. 20 at the Hotel La Salle, New York, after a brief illness. Mr. Robertson, who was 65 years of age, had come to New York to attend a meeting of the board of directors of the Equitable Life Assurance Society.

MISS HARRIET BILLINGS, for many years assistant secretary of the National Electric Light Association, died suddenly Nov. 3 at the Martha Washington Hotel, New York, where she had lived for a number of years. Miss Billings first became identified with the association in 1891, six years after its organization, in the capacity of assistant secretary and treasurer. This position she filled until 1906, when she retired from active work because of ill health. She not only acted in these capacities but took active charge of all the work of the committees; prepared all advance notices of the papers for the conventions, and for many years was editor of the *Proceedings* of the association.

Financial and Statistical News

Corrective Movement Checks Stock Rise

MARKET authorities who have consistently prophesied a collapse for several months past have little to say in these days of record trading volume and 50-point rises. But the more conservative element in Wall Street seems more convinced than ever that corrective movements are inevitable and that they will naturally be more severe in view of the speculative orgy under way. Of course, as usual, one can get about as many opinions of the outlook as the number of brokers he interviews. The only apparent limitation to trading activity at the moment is physical capacity, since funds seem to be pouring in in unlimited volume, not only from all parts of the country but from most of the foreign markets of the world. Ticker service under existing conditions is proving entirely inadequate.

Though public utility securities were not among the sensational climbers, many stocks of this type reported substantial gains during the week. On the big board American & Foreign Power advanced five points, American Water Works and Commonwealth Power three, Public Service Corporation of New Jersey four, North American six and Federal Light & Traction three. On the curb many of the utilities which had soared in the hectic market of last week sagged, including such stocks as Electric Bond & Share, Northeastern Power, Mohawk-Hudson Power and United Gas Improvement. American Gas & Electric gained.

Wagner Electric to Change Set-Up

In order to provide for the retiring, prior to maturity, of its outstanding bonded indebtedness and to encourage a wider distribution of the common stock, the Wagner Electric Corporation of St. Louis on Nov. 27 will submit to its stockholders for ratification two proposals for changes in its certificate of incorporation. The first of these changes is to increase from 80,000 to 100,000 the number of shares of the present no-par-value common stock, by offering assignable purchase warrants to shareholders entitling them to purchase one new share at $80 for each four present shares recorded in their names as of Nov. 27. Proceeds of the sale of this new stock, with other corporate funds, will then be used to retire on Feb. 1, 1929, the $1,599,200 of bonds now outstanding against the corporation.

After the common stock of the corporation has thus been increased to 100,000 shares of no-par value, it is proposed to exchange four shares of $15 par value for each outstanding share of no-par value, bringing the corporation's capital structure to 400,000 shares of the new $15 par value stock, in addition to the present 30,000 shares of $100 par 7 per cent cumulative preferred stock, of which 15,000 are outstanding.

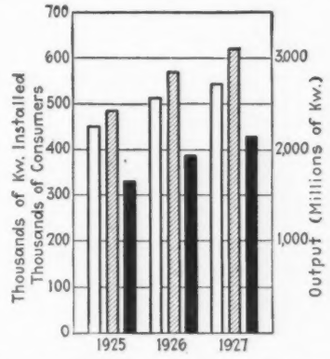
Dividends have already been declared on the outstanding no-par value common stock at the rate of $6 per year payable quarterly beginning Dec. 1, 1928, and ending Sept. 1, 1929. It is proposed to declare such dividends on the new $15 par shares for the first three quarters of 1929 as would be at least equivalent proportionately to the declared $6 dividend on the present no-par value stock.

American Power & Light Stock Appreciates

COMMON shares of the American Power & Light Company at this time last year were selling around 66 and during the current year they have realized a substantial appreciation in value, having climbed to about 81 at the present time from 62¼ in January. In fact, in May of this year the stock had reached 95. Retracing the price range the following table shows the trend since 1924:

1924	1925	1926	1927
69¼-37½	68½-48½	79½-48¼	73⅜-54

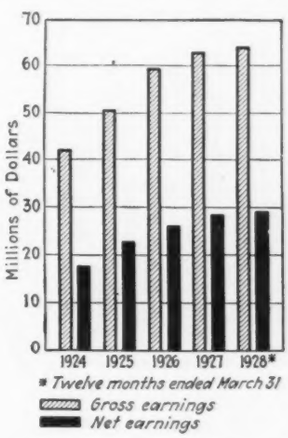
Back of this favorable market record is a steady increase in earnings for the American Power & Light subsidiaries, which served at the close of last year 790 communities in Arizona, Florida, Idaho, Iowa, Kansas, Minnesota, Nebraska, Oregon, Texas, Washington and Wisconsin with an aggregate population of 3,062,000. These figures do not include the Washington Water Power Company and the Montana Power Company, control of which was acquired in 1928. The Washington Water Power Company supplies electric light and power service in Spokane and 56 other communities in eastern Washington and



American Power & Light Company operating statistics

in sixteen communities in northern Idaho. The Montana Power Company and its subsidiaries serve the greater part of Montana, including the Butte, Anaconda, Billings and Great Falls districts, the most important centers of industry in the state, and also a section of Idaho.

Gross earnings of subsidiaries in 1925 amounted to $50,519,120, in 1926 to $59,411,694 and in 1927 climbed to $62,786,765. Net earnings of subsidiaries before appropriations for renewals and replacements advanced from $22,813,173



American Power & Light earnings show steady growth

in 1925 to $28,443,082 in 1927. The earnings statement issued for the twelve months ended May 31, 1928, shows gross of $66,192,405 as compared with $61,643,093 for the twelve months ended May 31, 1927, and net earnings before appropriations for renewals and replacements totaled $30,611,848 against $27,725,015. Gross earnings of the American Power & Light Company and undistributed income of subsidiary companies applicable to American Power & Light Company after appropriations for renewals and replacements amounted to $13,497,520 in 1927, as compared with $12,583,457 in 1926, and the balance after expenses, interests, dividends, etc., amounted to $6,207,783 in 1927, against

1923	2.41	1926	4.62
1924	3.39	1927	4.66
1925	4.28	1928*	4.66

*Twelve months ended March 31.

$5,663,719 in 1926. The table above shows the combined income applicable to the common stock in terms of earnings per share on the total number of shares outstanding at end of each year.

In addition to the expenditures made to maintain the physical properties in a state of operating efficiency, the subsidiaries in 1927 appropriated $3,531,290 to reserves for renewals and replacements. On Dec. 31, 1927, the balances in the renewal and replacement reserve accounts of subsidiary companies totaled $16,242,636.

American Power & Light subsidiaries added 131 communities to the number previously served, thus bringing the total served to 790 at the end of 1927. The subsidiaries gained 35,884 consumers and were serving a total of 749,266 as of Dec. 31, 1927. The total installed capacity of electric generating stations at the end of 1927 was 620,581 kw., an increase of 49,676 kw. for the year. Additional generating capacity was under construction at the end of the year to the amount of 24,400 kw. The addition of 1,700 miles of high-voltage transmission line by construction of new lines and by the acquisition of new properties brought the total mileage of such lines to 8,866. These operating statistics are exclusive of the Montana Power Company and the Washington Water Power Company. In the annual report for 1927 the Washington Water Power Company shows a maximum station load in horsepower of 171,742, as against 139,115 in 1926. The number of meters at the end of the year amounted to 52,849 and the kilowatt-hours generated and purchased to 633,019,740. At the close of 1927 the Montana Power Company had a total plant capacity of 245,000 kw. and the capacity of hydro-electric power sites undeveloped amounted to 107,000 kw. The total number of customers served by the company at the close of 1927 amounted to 49,844.

The power and light system of the Washington Water Power Company is interconnected with that of the Pacific Power & Light Company, another subsidiary of the American Power & Light Company, and a portion of the Montana Power Company system is interconnected with that of the Washington Water Power Company. The economies resulting from the co-ordinated operation and interconnection of these three systems will increase the diversity and add considerably to the stability of the parent organization.

American Power & Light Company

	1927	1926
Gross earnings	$10,176,831	$9,189,212
Expenses	349,332	364,433
Net earnings	9,827,499	8,824,779
Interest and discounts	2,991,118	2,796,020
Net income	6,836,381	6,028,759
Dividends	3,949,287	3,759,285
Balance after dividends	2,887,094	2,269,474
Renewals and replacements (depreciation)	3,531,290	3,524,808
Balance from operation of subsidiaries	3,320,689	3,394,245
Combined undistributed income	6,207,783	5,663,719

Kansas Gas & Electric Company

Gross earnings from operation	$4,992,451	$4,569,533
Operating expenses and taxes	2,918,811	2,668,971
Total income	2,392,160	2,218,548
Interest, dividends, etc.	1,625,135	1,562,615
Renewal and replacement reserve	350,000	350,000
Balance	417,025	305,933

Pacific Power & Light Company

Gross earnings from operation	$3,764,552	$3,751,266
Operating expenses and taxes	2,197,974	1,985,709
Total income	1,576,535	1,795,684
Interest, dividends, etc.	1,177,199	1,209,020
Renewal and replacement reserve	375,000	350,000
Balance	24,336	236,664

Northwestern Electric Company

Gross earnings from operation	$3,198,333	$2,827,282
Operating expenses and taxes	1,805,531	1,671,627
Total income	1,423,995	1,217,298
Interest, dividends, etc.	902,342	861,810
Renewal and replacement reserve	225,000	200,000
Balance	296,653	155,488

Nebraska Power Company

Gross earnings from operation	$4,876,387	$4,397,178
Operating expenses and taxes	2,533,381	2,260,645
Total income	2,522,661	2,341,326
Interest, dividends, etc.	1,302,506	1,211,386
Renewal and replacement reserve	300,000	300,000
Balance	920,155	829,940

Citizens Gas & Electric Company (Council Bluffs)

Gross earnings from operation	$957,300	$885,475
Operating expenses and taxes	709,989	656,288
Total income	252,420	234,567
Interest, etc.	90,625	87,692
Renewal and replacement reserve	40,000	40,000
Balance	121,795	106,875

Minnesota Power & Light Company

Operating revenues	$5,860,629	$5,523,347
Operating expenses and taxes	2,223,509	2,253,139
Gross corporate income	3,866,431	3,519,538
Interest, dividends, etc.	2,738,476	2,781,042
Renewal and replacement reserve	225,000	225,000
Balance	902,955	513,496

Superior Water, Light & Power Company

Gross earnings from operation	$882,366	$844,869
Operating expenses and taxes	550,674	520,746
Total income	334,927	324,123
Interest, dividends, etc.	104,591	104,250
Renewal and replacement reserve	43,400	42,500
Balance	186,936	177,373

Central Arizona Light & Power Company

Gross earnings from operation	$1,886,064	$1,638,722
Operating expenses and taxes	1,144,428	1,055,180
Total income	785,378	617,592
Interest, dividends, etc.	206,611	182,896
Renewal and replacement reserve	181,100	164,691
Balance	397,667	270,005

Florida Power & Light Company

Gross earnings from operation	$12,605,701	$13,101,520
Operating expenses and taxes	7,010,241	8,223,194
Total income	8,003,056	6,110,566
Interest, dividends, etc.	4,984,669	3,409,570
Renewal and replacement reserve	400,000	500,000
Balance	2,618,387	2,200,996

Southwestern Power & Light Company

Gross earnings of Southwestern Power & Light Company and undistributed income of subsidiaries applicable to Southwestern Power & Light Company after renewals and replacements	$5,025,503	$5,194,772
Expenses of Southwestern Power & Light Company	32,453	30,283
Interest, dividends, etc.	1,606,033	1,926,223
Balance	3,387,017	3,238,266

Texas Power & Light Company

Gross earnings from operation	$9,382,286	$7,794,378
Operating expenses and taxes	5,251,421	4,460,034
Total income	4,269,847	3,407,476
Interest, dividends, etc.	2,311,221	1,570,170
Renewal and replacement reserve	350,000	350,000
Balance	1,608,626	1,487,306

Fort Worth Power & Light Company

Gross earnings from operation	$3,001,279	$2,862,832
Operating expenses and taxes	1,551,632	1,430,562
Total income	1,471,071	1,458,770
Interest, dividends, etc.	366,143	367,579
Renewal and replacement reserve	200,000	180,000
Balance	904,928	911,191

Montana Power Company

Gross earnings	$8,032,201	$8,572,241
Operating expenses and taxes	3,059,960	3,105,599
Interest, pf. stk. dividends, etc	2,480,930	2,513,184
Reserve for depreciation	265,000	275,000
Balance for common stock	2,226,311	2,678,458

Washington Water Power Company

Gross revenue	$6,475,455	$6,050,686
Operating expenses and taxes	2,556,574	2,525,069
Interest, dividends, etc.	2,984,052	2,589,585
Retirement expense	1,039,764	945,355
Total to surplus Dec. 31	329,156	134,977

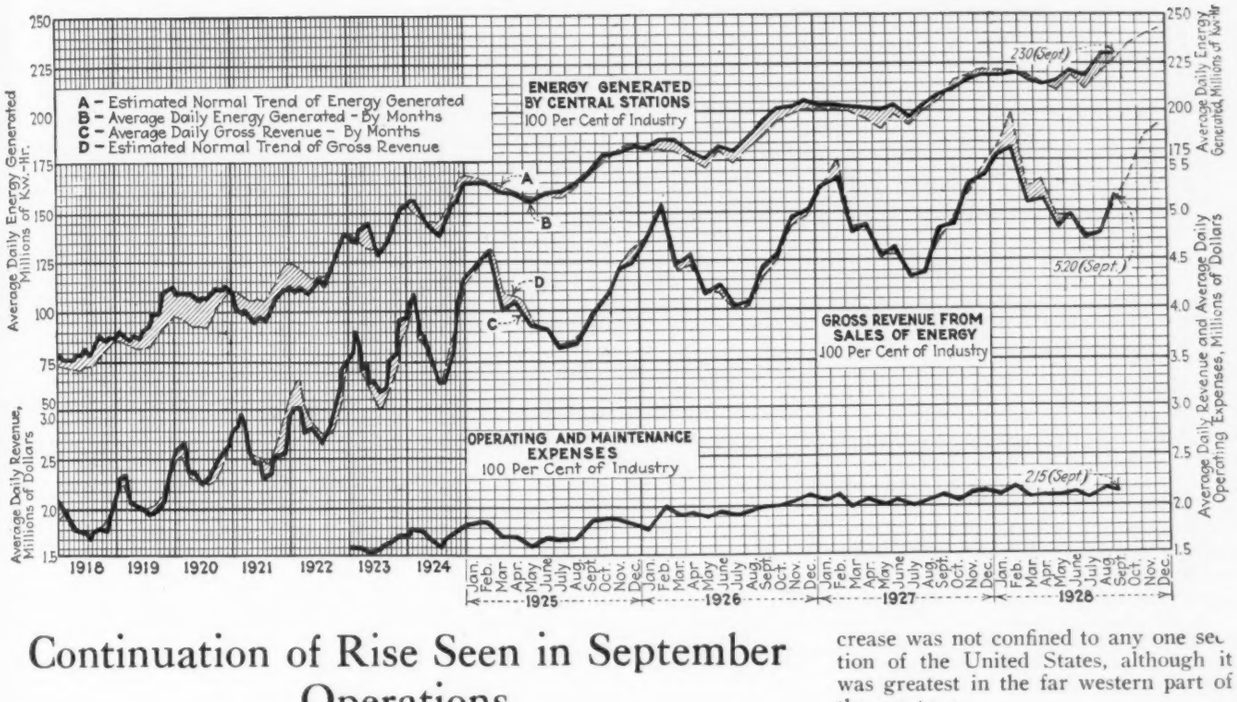
Electrical Energy Production in Europe

In the field of electricity post-war Americanization of European industry has been carried a long way, as pointed out by John Nickerson & Company, Inc. Total production of electrical energy in Europe has quadrupled since 1913. Much of the real progress has been made since then, assisted by large investment of American capital. In that period Germany, for example, has borrowed $210,000,000 of American capital for development of her natural and mechanical power industries and Italy $115,000,000 (out of the total of about $550,000,000 invested in the electrical companies of Italy).

In utilization of water power and railway electrification Italy holds first place in Europe. In France several of the largest railroad systems have also adopted a program of electrification, and it is planned to build a comprehensive system of high-tension and secondary lines interconnecting the various plants. The field for expansion is wide, as only 16,000 of the 40,000 communities in France are now using electric light.

Germany, with a greater per capita consumption than either France or Italy, has evolved twelve districts which interchange current with each other. The highly industrialized regions are increasing their consumption of electricity and absorb a large part of the total.

AMERICAN COMMONWEALTHS POWER INCREASES COMMON STOCK.—The directors of the American Commonwealths Power Corporation have authorized an increase in its common stock, all of which is owned by the American States Securities Corporation, to permit the acquisition of American Commonwealths Power shares by the present class A and class B stockholders of the American States company. This step is incidental to the proposed termination of the American States Securities Corporation, following which the American Commonwealths Power Corporation will be the central organization for the ownership and control of the American Community Power Company, the American Gas & Power Company and the Union Gas Utilities Company, operating in several Western and Southern States. A meeting of stockholders of both companies will be held Dec. 18 to act upon a merger of the companies.


A – Estimated Normal Trend of Energy Generated
B – Average Daily Energy Generated – By Months
C – Average Daily Gross Revenue – By Months
D – Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALES OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
Average Daily Energy Generated, Millions of Kw.-Hr.
Average Daily Revenue, Millions of Dollars
Average Daily Revenue and Average Daily Operating Expenses, Millions of Dollars
230(Sept.)
520(Sept.)
215(Sept.)
1918 1919 1920 1921 1922 1923 1924
1925 1926 1927 1928

Continuation of Rise Seen in September Operations

WITH earnings of $156,100,000 for the entire United States, according to monthly returns received by the ELECTRICAL WORLD from electric light and power companies, the revenue of the central-station industry in September exceeded that of the corresponding month in 1927 by 8.1 per cent. For the first time in 1928 it also exceeded the estimated normal based on operations in recent years, the average daily revenue being slightly in excess of $5,200,000, compared with an estimated normal of $5,105,000. It exceeded the figure for August by $7,900,000, a rise of 5.3 per cent, notwithstanding the fact that September is one day shorter than August and includes a holiday. This rise was in line with the usual sharp upward trend due to the coming on of the fall and winter lighting load.

As the following table shows, the increase was not confined to any one section of the United States, although it was greatest in the far western part of the country:

Region	Per Cent Increase Over September, 1927	August, 1928
New England	6.0	6.5
Atlantic	8.1	7.5
North Central	7.9	3.4
South Central	3.5	3.7
Western	11.3	1.2
United States	8.1	5.3

Although the rate of increase, compared with 1927, fell slightly short of

Table I—Central-Station Financial Operations for Four Months in the United States

(100 Per Cent of the Industry)

Month	Total Gross Revenue from Sale of Energy†			Estimated Distribution of Gross Revenue								Total Operating and Maintenance Expenses‡	
				Lighting Customers		Power Customers		Electric Railways		Other Public Utilities			
	1928 Thousands	1927 Thousands	Per Cent Inc.	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands
June	$149,500	$138,700	+8.2	$81,700	$75,700	$52,100	$47,800	$4,800	$4,400	$10,900	$10,800	$64,800	$62,700
July	146,600	134,300	+9.2	78,100	72,100	53,000	47,250	4,600	4,320	10,900	10,630	64,100	62,400
August	148,200	135,600	+9.3	80,100	74,800	52,750	47,400	4,500	4,100	10,850	9,300	66,400	64,100
Sept.	156,100	144,400	+8.1	82,800	78,200	57,300	50,400	4,600	4,400	11,400	11,400	64,500	61,300

†Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡Do not include interest, taxes, depreciation or sinking fund.

Table II—Generation and Distribution of Central-Station Energy in the United States

(100 Per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly*			Estimated Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business, Including Line Losses, Kw.-Hr.			
	1928 †Thousands	1927 Thousands	Per Cent Inc.	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands	1928 Thousands	1927 Thousands
June	6,637,610	6,127,247	+8.3	5,464,610	5,043,247	1,290,000	1,205,000	3,694,610	3,385,247	480,000	453,000	1,173,000	1,084,000	1,244,000	1,228,000
July	6,762,443	6,109,472	+10.7	5,567,443	5,028,472	1,330,000	1,242,000	3,762,443	3,338,472	475,000	448,000	1,195,000	1,081,000	1,246,000	1,178,000
August	7,122,684	6,335,335	+12.4	5,863,684	5,217,335	1,355,000	1,265,000	4,028,684	3,500,335	480,000	452,000	1,259,000	1,118,000	1,291,000	1,290,000
Sept.	6,915,183	6,222,002	+11.1	5,690,183	5,121,002	1,367,000	1,274,000	3,858,183	3,410,002	465,000	437,000	1,225,000	1,101,000	1,220,000	1,220,000

*Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.
†1928 figures are only approximately comparable with those for 1927, because of changes in classification of certain plants.

*Table III—Operations of Central-Station Hydro and Fuel Plants in the United States**

(100 Per Cent of the Industry)

Month	Energy Generated						Fuel Consumption								
	Hydro-Plants			Fuel Power Plants			Coal			Oil			Gas		
	1928 Thousands of Kw.-Hr.	1927 Thousands of Kw.-Hr.	Per Cent Increase	1928 Thousands of Kw.-Hr.	1927 Thousands of Kw.-Hr.	Per Cent Increase	1928 Short Tons	1927 Short Tons	Per Cent Increase	1928 Barrels	1927 Barrels	Per Cent Increase	1928 Thousands of Cubic Feet	1927 Thousands of Cubic Feet	Per Cent Increase
June	3,010,467	2,491,840	+20.8	3,628,148	3,635,407	—0.2	2,753,141	2,904,907	—5.2	477,037	453,025	+ 5.5	6,225,493	5,214,762	+19.4
July	2,977,413	2,401,852	+24.0	3,785,030	3,707,620	+0.2	2,878,022	2,996,291	—3.9	530,812	449,903	+18.0	6,962,322	5,598,713	+24.4
August	2,948,491	2,371,572	+24.9	4,174,193	3,963,763	+5.3	3,145,901	3,180,358	—1.0	585,024	480,022	+21.9	7,612,398	6,259,785	+21.6
Sept	2,704,548	2,191,325	+23.4	4,210,635	4,030,677	+4.4	3,134,261	3,183,450	—1.5	577,589	482,363	+19.7	7,226,210	6,466,951	+11.7

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

the mark set in the two preceding months, the difference is due to high activity in September, 1927, rather than to a slackening of the pace attained early in the summer of the current year.

The relative decrease in operating and maintenance expenses noted in previous months has continued; the estimated national total for this item, $64,500,000, is only 5.2 per cent greater than it was a year ago.

Of the energy output, amounting to 6,915,183,000 kw.-hr., or 11.1 per cent more than in September, 1927, the portion generated from fuel was 4,210,635,000 kw.-hr. and constituted 61 per cent of the whole; that from water was 2,704,548,000 kw.-hr. As is pointed out in a report on the subject by the United States Geological Survey, there was a decrease in the energy generated from water power compared with preceding months, due to the usual condition of low water at this time of the year.

Compared with former years, however, the output from water power continues to grow rapidly; it was 23.4 per cent greater than in September, 1927, while the output from fuel rose only 4.4 per cent. At the same time the consumption of coal decreased 1.5 per cent to 3,134,261 tons. The use of oil and natural gas both increased by a considerable fraction, but since in terms of heat energy these two fuels represent only about a tenth of the total, the various changes approximately balance one another.

Thirty Thousand Purchase Edison Company Stock

Evidencing the confidence which they feel in the future of the Southern California Edison Company, 30,096 individuals have, during the first ten months of this year, purchased Edison stock with a par value of more than $25,182,000, according to a statement coming from the office of R. H. Ballard, president of the company. This figure includes both cash and installment sales. Cash received from stock sales during this time amounted to $21,319,252.96, the balance of the stock having been sold on the installment basis.

The figure of 30,096 net individual subscriptions for this ten-month period includes both new and old stockholders. The average amount (par value) of stock purchased per subscriber during 1928 has been $850. It is interesting to note that of the total number of subscribers secured this year to date approximately 50 per cent were women.

On Nov. 1 the company had a total of 118,146 stockholders, owning stock with a par value of $168,781,522. The average holding per stockholder today is $1,425. This also is computed at par value of the stock.

Nearly $200,000,000 in Radio Apparatus and Tubes

The Department of Commerce announces that, according to data collected at the biennial census of manufactures taken in 1928, the establishments engaged in the manufacture of radio apparatus and tubes in 1927 reported products to the value of $191,848,665, an increase of 8.4 per cent as compared with $176,990,334 for 1925, the last preceding census year. Of these amounts radio tubes alone accounted for $21,170,610 in 1923, but for only $17,046,614 in 1925.

The production of tube-type receiving sets in 1927 was 1,938,192, valued at $94,050,031, a decrease of 19.1 per cent in number and an increase of seven-tenths of 1 per cent in value as compared with 2,395,790 sets, valued at $93,356,546, reported for 1925. The production of socket-power devices in 1927 aggregated 1,405,191, with a value of $23,357,814, or 13.4 per cent of the total value of radio apparatus manufactured during the year. The production of socket-power devices was very small in 1925 and the value was not reported separately, but was included in the value of miscellaneous radio parts.

Production statistics for 1927 and 1925 are presented in the accompanying table. The figures for 1927 are preliminary and subject to such correction as may be found necessary after further examination of the returns. The values reported are factory values, not retail prices.

RADIO APPARATUS AND TUBES

	1927	1925	Per Cent Inc. (+) or Dec. (—)
Aggregate value	$191,848,665	$176,990,334	8.4
Radio apparatus: Total value	$174,802,051	$155,819,724	12.2
Loud speakers: Number	2,446,264	2,844,652	—14.0
Value	$18,868,849	$18,955,916	—0.5
Head sets: Number	267,349	1,352,442	—80.2
Value	$316,726	$2,164,529	—85.4
Receiving sets[1]: Four-tube and smaller: Number	30,962		
Value	$613,715		
Five tube and larger:		2,395,790	—19.1
		$93,356,546	+0.7
Number	1,907,230		
Value	$93,436,316		
Transmitting sets, value	$2,233,483	$1,355,768	+64.7
Transformers: Number	4,093,160	5,295,507	—22.7
Value	$5,446,550	$7,614,774	—28.5
Rheostats: Number	2,327,275	3,562,543	—34.7
Value	$1,420,780	$2,018,592	—29.6
Socket-power devices: Number	1,405,191		
Value	$23,357,814	$30,353,599	72.8
Mis. parts, value	$29,107,818		
Radio tubes, value	$17,046,614	$21,170,610	—19.5

[1] Not including combination phonographs and radios, which are classified for census purposes in the "phonographs" industry.

Byllesby Organizes Mexican Company

H. M. Byllesby & Company have announced the organization of Empresa de Servicios Publicos de los Estados Mexicanos (Mexican State Public Service Company) for the acquisition of utility and industrial properties in Mexico. The transaction, according to the announcement made by John J. O'Brien, president of H. M. Byllesby & Company, includes the purchase by the Mexican States Public Service Company, Inc., of an electric plant at Hermosillo, capital of the State of Sonora, Mexico; purchase of the electric plant, ice plant and miscellaneous industries at Guaymas, in the State of Sonora, Mexico, and the purchase of the electric plant at Culiacan, in the State of Sinaloa, Mexico. Hermosillo has a population of approximately 18,000, Guaymas is a seaport city of approximately 10,000 population on Guaymas Bay, a part of the Gulf of California, and Culiacan is the capital of the state of Sinaloa with a population of approximately 20,000.

It has been provided that the Mexican States Public Service Company, Inc., the newly organized operating company, immediately will make substantial enlargements and line extensions of the electric plants at Hermosillo and at Guaymas.

Business News and Market Conditions

Electrical Manufacturing Output Passes Year's Peak

REPORTS received by the ELECTRICAL WORLD upon the monthly consumption of electrical energy by the electrical manufacturing plants of the nation indicate that September recorded the peak of operations for the current year and that the seasonal downward trend in productive operations is now under way. It appears that the downward trend normally witnessed near the close of the fall months has got under way a little earlier than usual. This is probably due to the record operations which were witnessed during September and which could not be expected to be maintained over any extended period.

The rate of productive activity in these plants during October, after corrections are made for the number of working days, was 2.4 per cent under the September peak, but was 4.6 per cent over October last year. That the current year as a whole is certain to witness materially increased production over 1927 is indicated by the fact that the average rate of production operations for the first ten months of the current year was 5.8 per cent over the same period last year. This is considerably above the rate of increase recorded during 1926 and 1927.

The index of activity in the electrical manufacturing industry based on the consumption of electrical energy stands at 137.1 in October, as compared with 140.5 in September and 131.3 in October last year. Comparative indexes of productive activity referred to the average productive activity for the period 1923-25 as 100 and adjusted for the number of working days are as follows:

October, 1928	137.1
September, 1928	140.5
August, 1928	119.4
July, 1928	120.8
October, 1927	131.3
Average first ten months, 1928	124.7
Average first ten months, 1927	117.9

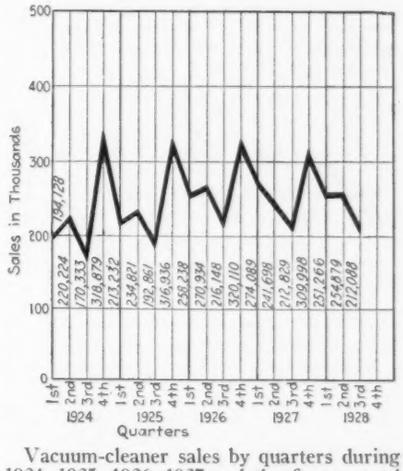
The present productive activities in the electrical manufacturing industry are following very closely the productive operations of the nation's industries as a whole. The peak of general industrial activity was recorded in September, with October a close second and February, usually the peak month of the year, in third position. October operations were 10.1 per cent greater than in the corresponding month last year.

Ayres on Business Outlook

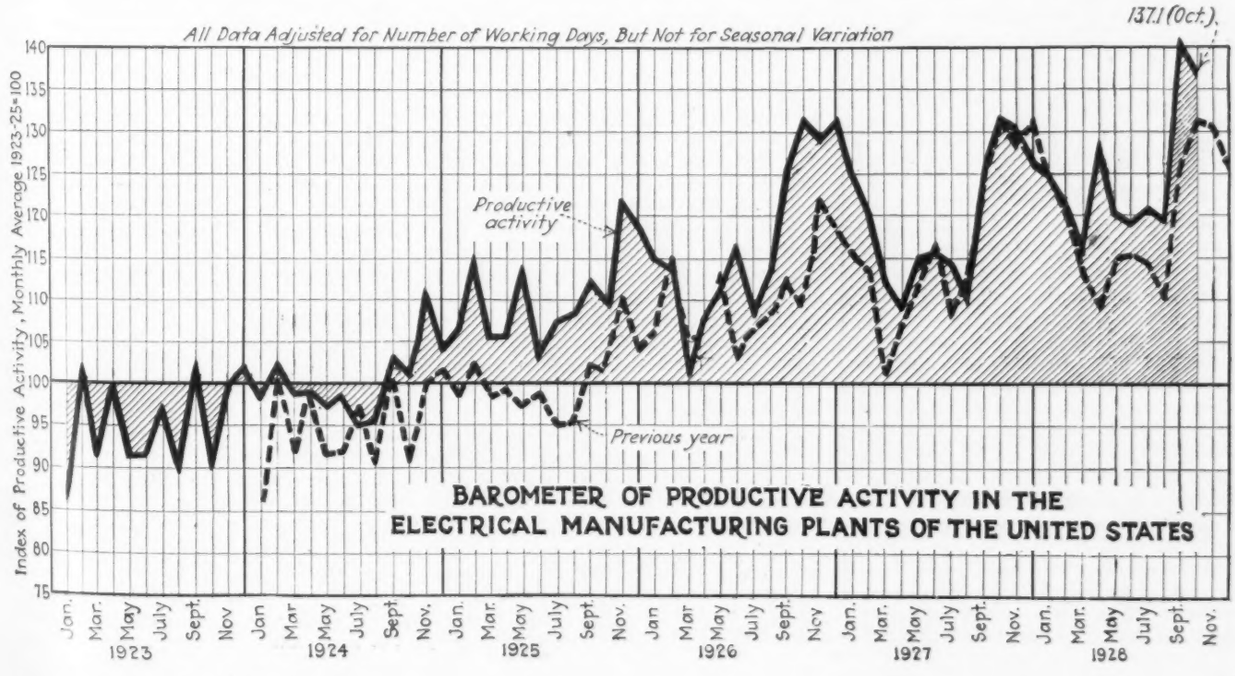
Dealing with the probable attitude of the Hoover administration toward the utilities and other branches of industry and business, Col. Leonard P. Ayres, vice-president of the Cleveland Trust Company, said last week:

Government will almost surely intervene in business much more during Mr. Hoover's administration than it did in those of President Harding and President Coolidge. It will probably be forced to whether its leaders wish it or not. Some positive action must be taken before long looking to railroad consolidations. As a result of the political campaign both parties are pledged to do something about farm relief. Both parties have promised tariff changes. Problems relating to water power, inland waterways, and the regulation of public utilities promise to assert themselves so insistently in Congress that something will have to be done about them. Well-supported proposals looking to the modification of Federal Reserve System legislation will inevitably be put forward. It seems clear that the administration of Mr. Hoover will not be able to follow the policy of less government in business.

Vacuum-Cleaner Sales



Vacuum-cleaner sales by quarters during 1924, 1925, 1926, 1927 and the first, second and third quarters of 1928. The figures for the first quarter of 1928 have been revised and differ from those which appeared in the ELECTRICAL WORLD, June 2, 1928, on page 1173. (Data supplied by Vacuum Cleaner Manufacturers' Association.)



Market Conditions

A SEASONAL slackening in orders for electrical equipment of various kinds is apparent in New England and to some extent in the Eastern district. In the latter area there is a sizable volume of marine equipment business, while industrial equipment continues in good demand. In the Southeast, however, buying has increased and the outlook for the balance of the year is exceedingly good.

Industrial and construction activity is reflected in increased buying of equipment in most sections of the Middle West and in the St. Louis district. It is on the Pacific Coast, however, that activity is apparently greatest. Large quantities of cable and other construction materials are changing hands, while substantial orders for motors and transformers are recorded.

Large-Scale Buying of Lead and Zinc

The re-entry of galvanizers into the prime Western zinc market during the past week has resulted in the largest tonnage of sales reported in considerably more than a year. Lead buying has been in large volume also. Business in both metals includes a preponderance of big-tonnage transactions. Tin prices have advanced, with good consumer demand backed by speculative buying in London. Copper has sold in close to normal volume.

NEW YORK METAL MARKET PRICES

	Nov. 14, 1928 Cents per Pound	Nov. 21, 1928 Cents per Pound
Copper, electrolytic	16.	16
Lead, Am. S. & R. price	6.35	6.35
Antimony	10.25	10.125
Nickel, ingot	35	35
Zinc, spot	6.60	6.60
Tin, Straits	50	51.625
Aluminum, 99 per cent	24.30	24.30

Base copper wire price Nov. 21, 1928, 17¼ cents.

Active Business Reaches Good Volume in Southeast

Activities are beginning to look up in the Southeast since the national election and the present indications are for a satisfactory volume of business during the remainder of the year. Several very large construction projects running into millions of dollars are under active consideration and announcements regarding them are expected within 60 days. One of the larger power companies ordered one 6,000-kw. high-pressure turbine and two 1,000-kw. turbines with switchboards and accessories, the orders totaling $160,000. Another company ordered creosoted pine poles aggregating $5,550 and distribution and small power transformers totaling $6,000. Some other central-station orders were for house type meters amounting to $1,900 and distribution transformers valued at $1,500.

A cotton mill in Tennessee ordered motor and switchboard equipment totaling $12,000. A total of 800 "white-way" standards were ordered for installation in an Alabama town and a town in Georgia, through its Chamber of Commerce, ordered 3,000 25-watt lamps for stringing on the city streets in connection with holiday decorations. A municipal plant of another town in Georgia ordered $2,000 worth of general supply materials. Construction projects are as follows:

The Mendota Milling & Supply Company, Mendota, Va., plans a cold storage and refrigerating plant to cost $40,000. Sears, Roebuck & Company, Chicago, plan a mail order storage and distributing plant at Alexandria, Va., to cost $250,000. The Tudor Ice & Cold Storage Company, Danville, Va., plans an ice-manufacturing plant to cost $130,000. The Jones Cold Storage & Terminal Corporation, Norfolk, Va., will carry out a cold storage plant project to cost $200,000. The Continental Lumber & Manufacturing Company, Jeffersontown, Ky., plans a hardwood mill to cost $65,000. The Southern Cities Power Company, Chattanooga, Tenn., will install a street lighting system at Dunlap, Tenn. The Stewart Paint Company, Alliance, Ohio, will build a factory at Spartanburg, S. C., to cost $75,000. The Lewis Grocery Company, Lexington, Miss., will build a cold storage and refrigerating plant at Durant, Miss., to cost $100,000. The Masonite Corporation, Laurel, Miss., will make improvements at its insulating board mill to cost $100,000. Swift & Company, Chicago, meat packers, will build a power plant at their produce and packing plant at West Point, Miss., to cost $150,000. The Alabama Power Company, Birmingham, Ala., plans a steam-operated electric power plant near Mobile, Ala., to cost $500,000.

New England Buying Scheduled Equipment

The steady buying of regular scheduled materials and equipment is reported by prominent manufacturers to be the reason for the continued strength in the market in the New England district. Small motor sales are heavy; orders totaling over $60,000 are reported by one company and by another a number of 50-hp. loom motors were reported. An order for motors and control equipment amounting to about $1,500 was received from a northern New England plant and a large assortment of small switch and control orders were noted, but generally in small amounts.

The trend in central-station supplies is less active and indications point to less interest to come. Meter sales slumped recently due to the closing up of new construction orders. A few scattered orders for transformers were recently received. Final closing up orders are being received for the completion of a number of new building projects, which have affected the sales volume recently in the movement of poles, of which two carloads were noted, and numerous orders for crossarm shipments, wire and line hardware. Construction projects are as follows:

Crocker Burbank & Company, Fitchburg, Mass., plan a paper mill.

The Keyes Fibre Company, Waterville, Me., plans a plant in Canada, to cost $100,000. The Old Colony Envelope Company, Westfield, Mass., contemplates extensions and improvements.

Sales Trend Upward in Eastern District

Sales continue to round out satisfactory totals for electrical equipment in the Eastern district, with conservative tendencies practically centered in heavy machinery for generating station and affiliated service. A feature of present activities is the increasing demand for marine equipment and sizable commitments are being placed. A shipbuilding company in New York has ordered electric drive machinery for a new South American liner from an Eastern maker, the contract totaling $275,000. A Philadelphia interest has given a commitment for a quantity of control apparatus for marine generating service to cost $50,000. Contractors for an electric ferry for the state of New York have placed an order for electric drive and control equipment aggregating $30,000.

Motor sales are particularly well sustained and inquiries that are coming in give every indication of continuance for some weeks to come. Fractional-horsepower units are attaining a new high record sales volume and show substantial increase over the figures at this time a year ago. A manufacturer of washing machines in northern New York has placed an order for fractional-horsepower motors to a sum of $25,000. Control apparatus and other industrial equipment carries a firm tone and the outlook is encouraging.

Central-station account shows little change or indication of immediate revival. A Pennsylvania manufacturer has secured an order for prime movers and auxiliary equipment for a proposed hydro-electric power development in Virginia. A drydock company in the metropolitan district has contracted for transformers and switching apparatus to cost $25,000. A manufacturer of line hardware and kindred equipment reports business as spotty, with a fairly steady volume of small orders from electric railways for maintenance and repair accounts.

Lighting apparatus is engaging under an increasing call and domestic appliances are developing a stronger tone. Electric refrigerators are enjoying substantial interest and transactions are encouraging both for immediate and future commitments. Vacuum cleaners are securing an improved account. Electric heating apparatus is coming into its season and the outlook is promising. Construction operations are as follows:

The International Paper Company, New York, plans a kraft paper mill on a Southern site, either North or South Carolina,

to cost $1,500,000. Stevens & Wood, Inc., New York, engineer, plans a transmission line and substation extensions for the Tennessee Electric Power Company, Chattanooga, Tenn., to cost $1,000,000. The Waterfront Service Corporation, Brooklyn, will build an addition to cost $130,000. The Quartermaster Corps, Fort Slocum, N. Y., will receive bids until Dec. 7 for conversion of a single-phase electric transmission system into a three-phase, four-wire system, and for secondary system (Circular 17). The Signal Corps Procurement District, Brooklyn, will receive bids until Dec. 4 for 2,500 audio-frequency transformers (Circular 42); also for 400,000 ft. of twin outside distributing wire (Circular 41). The Public Service Electric & Gas Company, Newark, N. J., will install an ornamental lighting system at Bloomfield, N. J. The Hoffman Beverage Company, Jersey City, N. J., plans an addition to cost $250,000. Patterson, N. J., is considering a floodlighting system at the Passaic River falls.

The Ford Motor Company, Highland Park, Detroit, plans extensions in its assembling plant at Chester, Pa., to cost $500,000. The Frankford Grocery Company, Philadelphia, plans an addition to cost $200,000. The Central Airport, Inc., Philadelphia, plans a floodlighting system, beacons, etc., at the aircraft field at Camden, N. J., to cost $1,500,000. The Viscose Company, Marcus Hook, Pa., will build an addition to its rayon mill at Parkersburg, W. Va., to cost $1,000,000. The Edward Katzinger Company, Chicago, manufacturer of baking machinery, will build a plant at Baltimore, Md., to cost $400,000. The American Oil Company, Baltimore, plans an addition to its plant at Curtis Bay, Md., to cost $100,000.

Cable and Wiring Material Feature Coast Business

The outstanding orders on the Pacific Coast include nine General Electric transformers and a switchboard for the Patterson district irrigation system, valued at $25,000, and General Electric motors of sizes 50 to 200 hp. totaling $30,000 for various steel companies. Other interesting orders include 70,000 lb. of copper wire for Glendale, valued at $13,000; a carload of insulators and steel pins, valued at $10,000, for a power company; 40,000 lb. of weatherproof wire, sizes No. 2/0 to No. 8, for a Hawaiian power company; $2,000 worth of wiring material for a Hawaiian warehouse and 6,000 lb. of magnet wire for the United States navy yard at Mare Island. Many state bids are reported, such as $1,000 worth of 5-kw. air heaters, $1,200 worth of lead cable, $1,200 worth of wiring material and $1,700 worth of 500,000-circ.mil weatherproof wire. Prospective street-lighting business includes a survey of San Francisco's system, a 55 single and 62 duplex system for Santa Maria, a 125 duplex light system for Oakland and various additions to the present systems in Alameda, Merced, Placerville and Redwood City. Other large prospective business includes a new can factory for Los Angeles, a $750,000 Sears-Roebuck warehouse for Portland, Ore., a 23-story apartment house for San Francisco, a $1,000,000 dormitory for Pomona College and a $2,000,000 oil distributing center for Portland, Ore. Bond issues aggregating $10,000,000 and including such potential electrical business as an airport and a traffic tunnel were voted at the recent election.

With the exception of the usual run of small motors sold to lumber mills and allied industrials for replacements and minor additions sales are reported to be light in the Puget Sound district. The city of Tacoma will increase the Cushman hydro-electric project by 30,000 hp. and bids for the construction of the dam, including driving and lining a 2½-mile, 17-ft. diameter tunnel and the construction of a power house, will be invited within a few weeks. The completed project is estimated at $2,000,000. The capacity of the Lincoln Street steam plant of the Northwestern Electric Company, Portland, is to be doubled, the work to start the first of the year, at a cost of $1,200,000. The Pacific Telephone & Telegraph Company plans the expenditure of $180,000 for the improvement of its long-distance facilities between Seattle and the Canadian border. Construction projects are as follows:

The San Joaquin Light & Power Corporation, Fresno, Calif., will build a 60,000-volt transmission line into Briceburg, Calif., 21 miles, and a substation at Briceburg, to cost $100,000. The Shell Oil Company, Oakland, Calif., will build a storage and distributing plant to cost $300,000. The Holland Fertilizer Company, Bellingham, Wash., plans a plant to cost $65,000. The Puget Sound Power & Light Company, Bellingham, Wash., plans extensions in the 13,000-volt transmission line and distributing system. Pasco, Wash., will make extensions and improvements in its street-lighting system to cost $18,000.

The Great Northern Railway Company, St. Paul, Minn., will make extensions in the locomotive shops at Whitefish, Mont., to cost $75,000. The Idaho Power Company, Boise, Idaho, plans a substation at Twin Falls, Idaho, to cost $30,000. The Colorado Fuel & Iron Company, Pueblo, Colo., plans an ore-treating and concentrating mill at Sunrise, Wyo., to cost $100,000. The Southern Colorado Power Company, Pueblo, Colo., plans a transmission line in the Canyon City district, to cost $40,000.

Buying Continues Active in St. Louis District

The steady buying trend of stock sizes of apparatus which has been noted for the past two months in the St. Louis district has continued, all manufacturers report, the volume holding up splendidly. There has been a marked increase in the orders for cooking and heating appliances. A contract was closed by a local manufacturer for two 1,250-kva. turbo-generating units costing $65,000. An order was placed for highway lighting fixtures of the latest type for illuminating the approaches and spans of one of the new vehicle bridges across the Mississippi River north of St. Louis. The cost of the material for the 2 miles of roadway was $3,000. Jobbers report a splendid business in all kinds of holiday appliances and radio apparatus. Construction projects are as follows:

St. Louis, Mo., plans a street lighting system to cost $450,000. The Oklahoma Gas & Electric Company, Oklahoma City, Okla., contemplates extensions in transmission lines to cost $50,000. The Southwestern Gas & Electric Company, Shreveport, La., plans a transmission line to Nash, near Texarkana, Ark., to cost $60,000. The Central Power & Light Company, San Antonio, Tex., plans a cold storage and refrigerating plant at Harlingen, Tex., to cost $35,000. The W. D. Haden Company, Galveston, Tex., will build a lime-manufacturing plant at Houston, Tex., to cost $135,000.

Business Accelerates in the Middle West

A slight acceleration in general business is noticeable in most sections of the Middle West. The volume of business transacted is increasing and a continued prosperity is anticipated. Reports from the steel and automotive industries continue favorable, with increased employment in the automotive centers. Car loadings are high with a varied assortment of commodities. Increased sales of the large mail order houses of Chicago indicate a satisfactory condition in the agricultural districts and the retail trade is increasing. Commitments are heavy, one utility company averaging $85,000 a day. Jobbers' sales are relatively satisfactory. There has been a good demand for vacuum cleaners, electric refrigerators and automatic toasters, one jobber placing a single order for twelve gross of the automatic toasters. Construction projects are as follows:

The Beloit Box Board Company, Beloit, Wis., contemplates an addition to cost $70,000. The University of Wisconsin, Madison, Wis., plans a mechanical engineering laboratory and building, to cost $575,000. The Brown-McLaren Manufacturing Company, Detroit, manufacturer of screw machine products, will build a plant at Melvindale, Mich., to cost $100,000. The Packard Motor Car Company, Detroit, plans an addition to its power house, to cost $85,000. The Chicago Pie Company, Chicago, plans a plant to cost $150,000. The Jewel Tea Company, Chicago, plans a plant at Barrington, Ill., to cost $500,000. The Public Service Company of Northern Illinois, Chicago, plans a substation at Chicago Heights, Ill., to cost $40,000. The Federal Pipe & Supply Company, Chicago, plans a plant unit to cost $250,000. The Frank Foundries Company, Moline, Ill., plans an addition to cost $300,000. The Crescent Coal Company, Evansville, Ind., plans a power plant to cost $30,000. The Hercules Motor Company, Canton, Ohio, plans an addition for testing service, to cost $100,000. The Cleveland Automatic Machine Company, Cleveland, plans a plant at Elyria, Ohio, to cost $100,000. The Chase Brass & Copper Company, Cleveland, contemplates an addition to cost $70,000. Columbus, Ohio, plans an addition to its municipal electric light and power plant, to cost $100,000. Donoff Brothers, Inc., Dayton, Ohio, plans a cold storage and refrigerating plant, to cost $100,000. The Columbus, Delaware & Marion Electric Company, Marion, Ohio, plans an addition to its power plant to cost $400,000. Cokato, Minn., plans a municipal light and power plant to cost $30,000. The Minnesota Power & Light Company, Duluth, Minn., will make extensions in its street lighting system.

Activities of the Trade

Russia Expands Output of Electrical Products

Production of electrical equipment in Russia for the fiscal year 1928 to 1929 is expected in that country to be 36 per cent higher than that in the year just closing, according to the Department of Commerce. The Russian electrical industry will go in more intensively for the production of cables, storage batteries and radio apparatus under the program outlined.

The first six months of 1928 Russia purchased from Germany only about 19 tons of insulated wire for the manufacture of electrical equipment, as compared with a total of 259 tons in 1927. During the first half of 1928 Germany exported to Russia only 43 tons of lead-covered cable, as compared with 279 tons during 1927.

On the other hand, Russia's imports of wound armatures from Germany have risen considerably. Germany's exports of these to Russia amounted to 150 tons in 1927, whereas during the first six months of this year the figure stands at 477 tons.

Western Electric Acquires Land for New Plant

The Western Electric Company has acquired 127 acres of land, including River View Park and a tract of Canton property adjoining it, where it will erect a $15,000,000 plant as a first unit for the manufacture of telephone cable. Work upon the factory building will begin shortly. It is expected that this first unit will be ready for operation by the end of next year, when 1,500 workers will be employed. This number will be increased from time to time as new departments for manufacture of other lines go into production.

THE BAKER-RAULANG COMPANY, Cleveland, manufacturer of Baker electric tractors, trucks and cranes, announces the appointment of A. J. Gates as its chief sales executive in charge of the national distribution of its industrial tractors, trucks and cranes, with headquarters at Cleveland. Mr. Gates has been associated with the Baker organization for the past ten years as distributor of its line throughout Ohio and Michigan.

THE ROME WIRE COMPANY, Rome, N. Y., a division of the General Cable Corporation, announces that Charles H. Kenney has joined the organization and will be occupied in field engineering work in the metropolitan New York area. Frank Bolster has also joined the staff and he will devote his time to engineering work in connection with the application of Trenchlay and other new Rome cables to the central-station field and will be located at Rome. The company also announces the opening of an office in the Chamber of Commerce Building, Cincinnati, with K. D. Clothier, formerly of the Cleveland office, in charge. The Philadelphia office is now located at the Fidelity Trust Building, 123 South Broad Street, and the Detroit office is now located at Room 1017, Fisher Building.

THE NATIONAL FLUE CLEANER COMPANY, INC., Groveville, N. J., manufacturer of soot blowers for fire tube boilers, announces the appointment of three new Ohio sales representatives, namely, the Craun-Liebing Company of Cleveland, the Dennis Engineering Company of Columbus and the Bishop Engineering Company of Cincinnati. Other recent appointments are the Power Plant Efficiency Company of Indianapolis, Ind., and the Rathburn Company of El Paso, Tex.

THE PENNSYLVANIA PUMP & COMPRESSOR COMPANY, Easton, Pa., announces the appointment of J. F. Rodgers, 726 Oliver Building, Pittsburgh, as its sales representative in that territory. Gustavo Preston, 113 Broad Street, Boston, has been appointed as its representative in the Boston district.

North American Company and Kolster Sign Wired Radio Contracts

THE closing of two contracts of far-reaching importance between Wired Radio, Inc., a subsidiary of the North American Company, and Federal Telegraph Company, a subsidiary of the Kolster Radio Corporation, has been announced by Frank L. Dame, president of the North American Company, and Rudolph Spreckles, chairman of the board of the Kolster Radio Corporation. Under the first of these contracts the Kolster Radio Corporation secured title to approximately 600 patents, patent applications and inventions in the communications, radio, wired radio, electric phonograph, television and talking motion-picture fields. These patents and inventions have been acquired by the North American Company during the past six years and their acquisition by Kolster marks an important transfer of radio patents. In discussing these contracts Ellery W. Stone, president of the Kolster Radio Corporation, said that the 600 patents acquired by Kolster Radio include several groups which patent attorneys state are widely infringed in the radio industry today and are expected to yield large royalties to Kolster as well as to place the company in an exceptionally strong position in the radio, electric phonograph and talking motion-picture fields. He stated also that exclusive licenses have been granted back to Wired Radio, Inc., by Kolster in the field of wired radio only and Kolster retains full title to all of the patents and exclusive manufacturing and selling rights in all fields other than that of wired radio. The second agreement, which remains in force until September, 1941, with renewal options, provides that Wired Radio, Inc., will purchase not less than one-third of its total requirements for apparatus from Kolster Radio Corporation on a cost plus 25 per cent basis.

Commenting further on the situation, Mr. Dame said:

The second contract forecasts the arrival of the industry's latest development, wired radio, which in the future will supplement, but not displace, present broadcasts on the air. Wired Radio, Inc., has been doing very important development work during the past six years on the transmission of radio programs over electric light and power wires. Experimental installation is now being made in Cleveland. There has been sufficient progress to make it necessary for the company to be assured of manufacturing facilities upon a large scale. In the contracts with Kolster, Wired Radio, Inc., is retaining all rights necessary to the development in its particular field. When plans have been completed wired radio will become available to all of the major public utilities of the United States.

According to officers of the companies concerned the sending of wired radio programs into homes over electric light wires will require special socket plug-in receiving equipment which will be manufactured by Kolster Radio Corporation and furnished to electric light customers at a nominal monthly rental. The sets will also be adaptable for reception from present-day radio broadcasting stations. Static, fading and station interference will be entirely eliminated by the wired radio system, and summer reception will be as good as winter. Also, reception difficulties encountered in cities on account of steel frame buildings will be overcome. Rental charges for wired radio apparatus, which will include maintenance, will be a moderate monthly fee. There will be three channels in operation at the outset, according to present plans. One will carry a program of classical music, another of more popular entertainment and a third will be devoted to lectures and educational programs. It is planned to establish a master studio for the entire United States from which programs by well-known artists will be sent out to wired homes in all parts of the country.

Mr. Spreckles, chairman of Kolster and also of Federal Telegraph and who owns a majority of the stock of the Kolster Radio Corporation, said:

When I purchased control of the Federal Telegraph Company, which was engaged primarily in radio communication on the Pacific Coast, I realized the importance to its stockholders of securing a greater

diversification in the company's business as well as a nation-wide expansion.

The first step was accomplished by acquiring the subsidiaries of C. Brandes, Inc., manufacturer of radio head sets and loud speakers, with plants at Newark, N. J., Toronto, Canada, and in England. The next constructive step was the negotiation of a contract with the Columbia Phonograph Company under the terms of which Columbia purchases exclusively from Kolster all of the electric phonographs and radio sets for combination therewith which Columbia requires in its rapidly expanding business.

This was followed by an exceedingly important contract with the Radio Communication Company, a subsidiary of the Mackay Companies, which latter group of companies was subsequently combined with the International Telephone & Telegraph Corporation. This contract gave the Kolster Company an important interest in world-wide radio communication, including a greatly enlarged manufacturing outlet.

The contracts executed today will give the Kolster Radio Corporation a commanding position in another important development stage of the radio industry, that of wired radio, by which radio programs will be supplied to homes over electric light wires.

THE GRISCOM-RUSSELL COMPANY, 285 Madison Avenue, New York City, manufacturer of power plant steam specialties, has opened a new branch office in Memphis, Tenn.

THE DALTON ELECTRIC HEATING COMPANY, INC., 287 Bridge Street, Salem, Mass., announces the appointment of the Dodson Printers Supply Company, 75 Forsyth Street, Atlanta, Ga., as its agent for its electrically heating embossing plates in the Southeast.

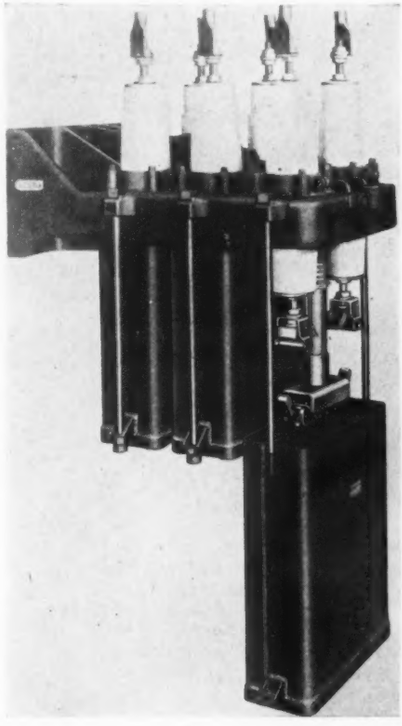
THE AMERICAN ELECTRIC SWITCH CORPORATION, Minerva, Ohio, announces that it has placed a direct factory representative in the Metropolitan district, discontinuing the services of Holland & Monaghan, manufacturer's representatives. The company also announces that its New York office and warehouse is now located at 430 East 53d Street with G. E. Lindstrom as manager.

CURTIS LIGHTING, INC., 1119 West Jackson Boulevard, Chicago, manufacturer of "X-ray" reflectors, announces the appointment of two new resident engineers. P. M. Rutherford will represent the firm in Alabama, Florida, Georgia and eastern Tennessee, with offices at 310 Bona Allen Building, Atlanta, Ga., and E. E. Parks will manage the Mississippi Valley territory, including Arkansas, Louisiana, Mississippi and western Tennessee, and will make his headquarters in the Builders Exchange at Memphis, Tenn. Both men were previously active in the Chicago office of the company. The company also announces the appointment of H. O. Bourkard as manager of the CurtiStrip division, in charge of the national sales promotion activities on "CurtiStrip," the standardized wiring device manufactured by the company, and will make his headquarters at Chicago. Mr. Bourkard has been resident engineer for the company in the southeast for the past ten years.

New Equipment Available

High Capacity Breaker for 15 Kv. and Less

A new oil circuit breaker of moderate capacity for the control and protection of feeders in substations and in industrial service has been perfected by the Condit Electrical Manufacturing Corporation. The frame is strongly constructed with deep extending web surrounding the tank. Strong tank-per-pole construction is used of thick steel plate



scientifically welded. Inverted laminated brushes are of special design to withstand extremely high inrush currents. Exceptionally heavy arcing contacts materially reduce arcing on interruption. This circuit breaker is furnished with 400, 600, 800 and 1,200-amp. at 15,000 volts, 1,600 amp. at 7,500 volts. The estimated interrupting capacity is 2,700 amp. at 15,000 volts.

Welding Electrode

Announcement comes from the research laboratories of the Lincoln Electric Company, Cleveland, of the perfection of its most recent development, a welding electrode to be known as "Fleet-Weld." A new welding rod has been perfected which it is claimed will produce a dense weld of greater ductility at greatly increased welding speeds. It is stated that recently conducted tests show that the speed of welding has been doubled or trebled by use of the new rod. Greater speed in welding should, of course, be reflected in lower welding costs.

The wide use of high-speed electrodes has been retarded in the past, due to the porosity obtained when the higher currents necessary for fast welding are used. It is claimed that the newly developed rod has overcome this difficulty. Greater ductility of the bead as well as deeper penetration are two of the requisites of better welding, which are also claimed for the newly developed high-speed wire.

The electrode itself is an extruded wire that permits high-speed welding without loss of denseness and ductility to the weld metal. While "Fleet-Weld" electrode has so far been a laboratory product, it is expected to be commercially manufactured and placed on the market in the near future.

Adjustable Step-Down Transformer

A new adjustable step-down transformer has been placed on the market by the Radiart Laboratories, Inc., Cleveland. It is stated that this new unit makes alternating-current receivers and eliminators as manufactured in the United States applicable for use in all foreign markets. The new feature of this transformer is that it is equipped with a special four-point switch which is connected to the tapped primary winding. It is thoroughly insulated from the transformer and positive in action. The switch is readily accessible.

Boundary and Obstruction Light

A new Department of Commerce standard boundary and obstruction light has been announced by the Holophane Company of New York. The globes are of a special screw type with refracting prisms on the inside of the globe. The candlepower of the lamp is increased in all upward directions.

ELECTRIC CIGARETTE LIGHTER—An electric cigarette lighter to be suspended from a lamp and equipped with a snap-switch is announced by A. W. Franklin, Inc., of New York. The lighter body is equipped with a long-life resistance element of new design and it is suitable for cigarette, cigar or pipe. All that is necessary for installation is to screw the plug end of the lighter into the standard socket and screw the lamp into the socket end of the plug.

WALL OUTLET RANGE.—A wall outlet electric range operating from any convenience outlet without special wiring was recently displayed by the Armstrong Electric & Manufacturing Corporation. The range has a capacity suitable for a larger than average family and is portable.

Electrical Patents

Announced by U. S. Patent Office

(Issued Nov. 6, 1928)

1,690,283. BRACKET SOCKET; V. R. Despard, Valparaiso, Ind. App. filed Oct. 30, 1925.

1,690,291. INSULATOR; M. F. H. Gouverneur, Baltimore, Md. App. filed Nov. 11, 1924.

1,690,293. HOUSEHOLD COMMODITY INDICATOR; G. B. Hall, Winnipeg, Manitoba, Can. App. filed May 23, 1927.

1,690,310. BATTERY TERMINAL; H. E. Pieh, Williston, N. D. App. filed April 13, 1927.

1,690,345. ARMATURE-TESTING APPARATUS; L. E. Poole, Anderson, Ind. App. filed May 28, 1926.

1,690,348. ELECTROMAGNETIC MOTOR; H. Wallace, Dayton, Ohio. App. filed May 25, 1925.

1,690,357. DISCONNECTING SWITCH FOR TRANSMISSION LINES; A. O. Austin, Barberton, Ohio. App. filed Aug. 11, 1924.

1,690,366. FULL SWITCH; D. D. Gordon, Chicago, Ill. App. filed Feb. 15, 1926.

1,690,377. METHOD OF WELDING PARTS; E. Pugh, Chicago, Ill. App. filed Sept. 15, 1926.

1,690,379. HEATER; C. T. Siebs, Riverside, Ill. App. filed Nov. 14, 1924.

1,690,392. INSULATOR PIN; A. O. Austin, Barberton, Ohio. App. filed May 12, 1920.

1,690,414. CONTACTOR; T. S. Kemble, Cleveland, Ohio. App. filed July 18, 1924.

1,690,415. ELECTRIC MELTING POT; F. Kuhn and L. H. Thomas, Detroit, Mich. App. filed Jan. 30, 1928.

1,690,430. SWITCH MOVEMENT; C. M. Petersen, Bridgeport, Conn. App. filed April 9, 1926.

1,690,473. OPERATING MECHANISM FOR CIRCUIT CONTROLLERS; P. Brown, Herndon, Kan. App. filed May 10, 1927.

1,690,486. DEVICE FOR GIVING WARNING OF FIRE; E. Half, Paris, France. App. filed Sept. 18, 1924.

1,690,489. AUTOMATIC CONTROL DEVICE FOR ELECTRIC-ARC WELDING APPARATUS; W. R. Hume, Melbourne, Australia. App. filed Sept. 21, 1925.

1,690,524. SWITCHING SYSTEM; R. G. Berthold, Berlin-Siemensstadt, Germany. App. filed June 22, 1926.

1,690,538. MAKE-AND-BREAK DEVICE; F. R. House, Brooklyn, N. Y. App. filed Dec. 11, 1920.

1,690,545. GYROCOMPASS TRANSMITTER; C. B. Mills, Brooklyn, N. Y. App. filed Oct. 9, 1922.

1,690,550. SEARCHLIGHT SAFETY MECHANISM; M. L. Patterson, Bogota, N. J. App. filed Sept. 3, 1924.

1,690,553. ARRANGEMENT OR SYSTEM FOR OPERATING MECHANICAL RECTIFIERS FOR ALTERNATING CURRENT; R. Rüdenberg, Berlin-Grunewald, Germany. App. filed Dec. 1, 1925.

1,690,566. CURRENT-BALLASTING DEVICE; A. W. Ziegler, South Orange, N. J. App. filed Oct. 5, 1925.

1,690,569. OSCILLATOR SPRING; L. F. Curtis, Springfield, Mass. App. filed Feb. 8, 1928.

1,690,573. STORAGE-BATTERY SEPARATOR ELEMENT AND METHOD OF PRODUCING SAME; N. Fallek, Los Angeles, Calif. App. filed May 4, 1925.

1,690,579. SYSTEM FOR THE PRODUCTION OF AND DETECTION OF COMPRESSIONAL WAVES; J. H. Hammond, Jr., Gloucester, Mass. App. filed Oct. 3, 1918.

1,690,580. MEANS FOR PROTECTING ELECTRICAL LINE CONDUCTORS; F. Hedley, Yonkers, and J. S. Doyle, Mt. Vernon, N. Y. App. filed July 3, 1924.

1,690,596. INSULATOR PIN; C. P. Seyler, Pittsburgh, Pa. App. filed May 14, 1925.

1,690,618. TROLLEY HEAD; H. P. Chandler, Mansfield, Ohio. App. filed Aug. 23, 1927.

1,690,653. TESTING DEVICE; W. H. Tarver, Pooler, Ga. App. filed March 26, 1925.

1,690,657 and 1,690,658. FILLING OF JOINT BOXES FOR ELECTRIC CABLES AND APPARATUS THEREFORE; A. E. Wilson, Bromley, England. Apps. filed June 18, 1925.

1,690,674 and 1 690,675. ELECTRICAL CONDENSER; P. E. Gilling, East Orange, N. J. Apps. filed Feb. 19 and 25, 1925.

1,690,678. ELECTRICAL RESISTANCE FURNACE; A. J. Hanson, Arlington, Mass. App. filed Jan. 23, 1924.

1,690,683. CLAMP FOR ELECTRIC SOCKETS; G. A. Johnson and F. E. Johnson, New Bedford, Mass. App. filed May 6, 1926.

1,690,689. PRESSURE-ACTUATED ELECTRIC-CIRCUIT CONTROL; I. E. McCabe, Chicago, Ill. App. filed April 12, 1926.

1,690,693. CANDLE SOCKET; K. K. Nielsen, Chicago, Ill. App. filed Jan. 28, 1927.

1,690,717. THERAPEUTIC LAMP; L. Brown, Des Moines, Iowa. App. filed Aug. 18, 1927.

1,690,761. AGRICULTURAL APPARATUS; H. I. Washburn, Magnolia, N. J. App. filed July 10, 1926.

1,690,780. ELECTRIC SWITCH; A. C. Gaynor, Stratford, Conn. App. filed Aug. 2, 1926.

1,690,795. ELECTRIC FURNACE; G. Sagramoso, Milan, Italy. App. filed May 19, 1924.

1,690,804. CLOSURE; F. G. Wikstrom, Brooklyn, N. Y. App. filed March 31, 1927.

1,690,831. ELECTRIC HEATING AND SURFACE-FINISHING DEVICE; M. Nieto, Brooklyn, N. Y. App. filed Feb. 25, 1928.

1,690,845. CONTACT TERMINAL; A. G. Steinmayer, Milwaukee, Wis. App. filed Oct. 12, 1925.

1,690,898. TIME AND TEMPERATURE CONTROL OF HEATING ELEMENTS; G. H. Hart, West Hartford, Conn. App. filed March 4, 1927.

1,690,940. LAMP-SOCKET-SECURING MEANS FOR ELECTRIC FIXTURES; H. E. Nickerson, Bridgeport, Conn. App. filed July 26, 1926.

1,690,943. VARIABLE-VOLTAGE TRANSFORMER FOR ELECTRIC-ARC CUTTING AND WELDING APPARATUS; F. C. Owen, Fayetteville, N. C. App. filed Sept. 22, 1927.

1,690,949. APPARATUS FOR MEASURING THE RATE OF FLOW OF FLUIDS; G. Sacco Albanése, Paris, France. App. filed June 7, 1924.

1,690,953. ALTERNATING-CURRENT INDUCTION MOTOR; L. Schön, Essen, Germany. App. filed Oct. 2, 1926.

1,690,986. HEATING DEVICE; B. W. Macy, Jacksonville, Fla. App. filed Sept. 21, 1927.

1,690,989. MULTIPLE-STRING INSULATOR SUSPENSION; R. H. Marvin, Liverpool, Ohio. App. filed May 24, 1926.

1,690,994. ELECTRIC HEATER; D. U. Powell, Woodsfield, Ohio. App. filed Oct. 10, 1927.

1,690,996. ELECTRIC SWITCH; C. D. Ainsworth, Wollaston, Mass. App. filed Sept. 21, 1927.

1,691,014. REBASING LAMPS; R. C. Leake, Rochester, N. Y. App. filed July 28, 1922.

1,691,016. TEMPERATURE-CONTROL SWITCH; I. E. McCabe, Chicago, and R. W. Armstrong, Wilmette, Ill. App. filed April 10, 1926.

1,691,022. VOLTAGE REGULATOR; G. B. Crouse, Woodcliff, and J. L. Jatlow, Elizabeth, N. J. App. filed Sept. 8, 1926.

(Issued Nov. 13, 1928)

1,691,084. DEVICE FOR INDICATING DENSITY OF LIQUIDS; F. Schwartz, New York, N. Y. App. filed Oct. 6, 1926.

1,691,088. TERMINAL BLOCK; A. L. Starke, Brookhaven, N. Y. App. filed Jan. 3, 1927.

1,691,091. ALTERNATING-CURRENT RELAY; E. O. Thompson, Tompkinsville, N. Y. App. filed July 19, 1922.

1,691,095. ELECTRICAL SYSTEM OF DISTRIBUTION; L. H. Von Ohlsen, New Haven, Conn. App. filed Feb. 20, 1926.

1,691,137. COMBINATION LAMP AND SMOKER'S STAND; O. A. Schuchert, Elgin, Ill. App. filed Oct. 11, 1926.

1,691,150. ELECTRICAL POWER-LIMITING DEVICE; G. Crisson, East Orange, N. J. App. filed May 2, 1925.

1,691,203. ELECTROMAGNETIC INSTRUMENT; T. L. Lee and H. C. Rohr, Rochester, N. Y. App. filed Aug. 27, 1923.

1,691,206. ELECTRICAL APPARATUS; L. L. Nettleton, Edgewood Borough, Pa. App. filed Sept. 14, 1926.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Montevideo, Uraguay (No. 34,407), for electrical appliances.

Purchase is desired in Colon, Panama (No. 34,429), of electrical bake-oven accessories.

An agency is desired in Mexico City, Mexico (No. 34,380), for portable electrical drills.

An agency is desired in Melbourne, Australia (No. 34,349), for electric heaters, street lighting fixtures and electrical theater equipment and another (No. 34,384), for semi-indirect lighting fixtures.

Purchase or agency is desired in London, England (No. 34,381), for household electrical appliances and electric portable tools and industrial lighting equipment.

Purchase is desired in Saalfeld, Germany (No. 34,378), of fractional-horsepower motors and compressor units for household refrigerators.

Purchase and agency are desired in Mexico City, Mexico (No. 34,483), for electrical household refrigerators.

Purchase or agency is desired in Cardiff, Wales (No. 34,383), for electric vibrators.

Purchase is desired in Groningen, Netherlands (No. 34,382), of copper wire.

New Trade Literature

LIFT TRUCKS.—The Stuebing Cowan Company, Cincinnati, Ohio, is distributing a booklet entitled "Straight Line Trucking," which describes the use of the lift truck platform system used by railroads and other common carriers. The book contains reproductions of photographs illustrating the handling of materials in the stores department and machine shops and freight at railroad and steamship terminals.

TROLLEY CAR EQUIPMENT.—Supplement No. 2 to catalog No. 20 issued by the Ohio Brass Company, Mansfield, Ohio, describes and illustrates its car equipment such as hangers, bonds, clamps, frogs, headlights, insulators, switches, trolley wheels and harps, etc. This bulletin supersedes and replaces its supplement No. 1.

POLYPHASE INDUCTION MOTORS.—The Allis-Chalmers Manufacturing Company, Milwaukee, Wis., is distributing bulletin No. 1087-F, which describes and illustrates its type AN squirrel-cage and type ANY slip ring polyphase induction motors.

ELECTRIC RANGE.—A folder issued by the Armstrong Electric & Manufacturing Corporation, Huntington, W. Va., describes its new wall outlet range which operates from any convenience outlet without special wiring.

CLAMPS.—Sales bulletin No. 2 issued by the Malleable Iron Fittings Company, Branford, Conn., covers its suspension clamps for aerial power cables. Illustrations are given demonstrating installations of the clamps.

INDUSTRIAL LIGHTING.—The Holophane Company, Inc., 342 Madison Avenue, New York City, has issued bulletin No. 448-A covering Holophane industrial lighting specifics and their application. The information contained in this bulletin would be of value to industrial plants, industrial architects, electrical contractors, central stations, etc.

AUTOMATIC PUMPING.—Bulletin No. 850 issued by Barrett, Haentjens & Company, Hazelton, Pa., describes a method used to make suction lift centrifugal pumps automatic. It shows how the centrifugal pump can be started and stopped by a float switch, push button, pressure regulator or time switch and also explains the way in which the pump is primed, and describes the devices used to protect the pump and electrical equipment against damage due to loss of prime, suction air leaks and other operating difficulties.

SWITCHES.—The Electric Power Equipment Corporation, Philadelphia, is distributing bulletin No. 206 which covers its single tilting insulator type "Elpeco" horn gap switches, known as type S. It gives details of construction, line drawings and operation of the switches.

FLEXIBLE SHAFTS.—The Stow Manufacturing Company, Inc., Binghamton, N. Y., has issued a publication covering the Stow flexible shafts for use with all types of attachments and for applications where portable rotary motion and distant control are desired. The company also is distributing a pamphlet describing its portable electric drills.